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Efficient Generation

THE Electricity Commissioners' "Fuel Returns" provide year by year an opportunity to consider our methods of generation. Three ways of reckoning operation efficiency are open to us: the relation between the number of B.th.u. in a pound of fuel burned and the number available at the bus-bars; the weight of fuel consumed in the production of a kWh; and the cost of the fuel required to generate each kWh.

The last of these gives us the information we really want, but by itself it is of little value in comparing the merits of different stations. A low cost might, for instance, be due to the existence of a local supply of cheap coal which could more economically have been burned at a better site even after adding transport charges. Neither does low unit weight provide a satisfactory figure of merit; this might be the result of paying an unjustifiable price for coal of high calorific value.

The best criterion for practical purposes, and the one which settles a station's technical status, is thermal efficiency. It is not, perhaps, an ideal standard of comparison. It shares with the others the defects that results may have been achieved through excessive capital expenditure or through extravagant energy consumption by auxiliaries (the official returns being based on kWh generated and not on kWh sent out), though in practice, to the best of our belief, such is not the case.

The representative sampling of coal may involve difficulties in determining calorific value accurately over short periods, but the consistency in individual returns year after year indicates that such difficulties are sometimes over-estimated.

For stations with the same type of prime-mover, the highest thermal efficiency must be regarded as the "blue ribbon," and for last year this was awarded to Clarence Dock, with 26.06 per cent., a notable advance on the figure (24.72 per cent.) with which it secured the premier position in 1932.

Yet even so notable an achievement may not be good enough to enable it to retain its place if Ironbridge and Battersea this year fulfil the promise of their first months of operation in 1933, in which they returned 26.84 and 26.15 per cent. The new Blackburn Meadows gave good results, but will probably give better; the Dunston 50-cycle station has not yet worked under favourable load conditions, and, like other selected stations on the North-East Coast, shows signs of the difficulties of normal operation during frequency standardisation.

Most of the selected stations have more than maintained their good record. The reconstructed Thornhill, which moved from 13.69 to 20.05 per cent. in 1932, made another jump to 25.42, and the two Clyde Valley stations, and Hackney also, showed marked improvement.

The increased output of nearly 10 per cent. in 1933 required little more than half the amount of fuel per kWh in 1932. Taken in conjunction with the outstanding performance of the newer stations and the steady improvement of the older ones, this result shows that, in operation as well as in design, the technical lines of generation in this country are sound.

The Milch Cow

THE Birmingham undertaking is the latest victim of our chaotic local rating methods. Of the net increase in total rateable value of the city arising from the quinquennial valuation no less than 30 per cent. is debited to electricity supply. This means that the rates payable by the Department are to be raised this year by over a third, while the total amount is equivalent to 11¼ per cent. of the gross annual revenue, as against an average for the country in 1931-32 of 7.53 per cent But for this the prices to consumers could, presumably, have been reduced by twice the amount proposed, making the undertaking an even greater asset to the city. This tendency to mulct electricity supply in rates is an evasion of the intention of the fifth schedule to the 1926 Act. Mr. J. N. Waite showed in his chairman's address to the Midlands Centre of the I.E.E. that the rates payable by different under-

takings vary fantastically. A uniform system of assessment, as Mr. P. J. Robinson suggested in his presidential address to the I.M.E.A., should do much towards removing a definite obstacle to electrical progress.

Grievance or Opportunity?

AT a recent meeting of the East Kent branch of the Electrical Contractors' Association indignation was expressed at the Ramsgate Electric Supply Co.'s offer to provide an installation free of charge to anybody agreeing to take a supply under its two-part tariff system. While we can appreciate the contractors' feelings, we must commend the company for its enterprise. Do the contractors think that the bulk of this work would be available to them if the company did not do it gratis? In any event, the type of installation offered is totally inadequate for a house of any size, consisting merely of three lighting points and a plug. Hasn't an opportunity been presented to the contractors to point this out and persuade the consumers concerned to pay for the remainder of a complete installation?

Improvement in America

DURING the great slump in the United States the electrical industries —supply and manufacturing—suffered rather badly. Figures now published by the Edison Electric Institute show that the downward tendency in the sales of electricity was arrested in 1933; the total sales of 65,754 million kWh represented an increase of 3.1 per cent. as compared with 1932. An analysis shows that the increase was due mainly to the electrified steam railroads and to "municipal and miscellaneous." Domestic supplies, representing less than 20 per cent. of the total, showed a very small decrease. The total revenue was reduced by 3.2 per cent. for the year. On the manufacturing side, the *Electrical World* shows that the index of activity has risen considerably this year. Employing as a basis (100) an average month of the period 1923-25, the figure rose from 97.1 in January to 133.4 in May —the highest point since the middle of 1931. The improvement seems to have been a general one, and the prevailing tone in the United States is optimistic.

National Electricity?

THERE is a possibility, according to a *Reuter* message, that the word "Elektrizität" may disappear from the German language in favour of "Bern," an abbreviation of Bernstein. Bernstein means amber, which again is the English way of writing the word of Greek origin "electricity." The latter may be a "tongue-twisting international word," as is suggested. We agree that it has little claim to regard on the score of euphony, but its similarity of pronunciation in the most widely spoken languages is very much in its favour. It reminds us that scientific progress is based upon the contributions that men of intellect everywhere can make to the common stock of knowledge. All that there is national in it is the legitimate pride that any people may feel that one of their number has shed lustre on the land of his birth. We believe the spirit behind the work of the International Electro-technical Commission to be more powerful among engineers than "nationalism."

Current-loading of Cables

THE rate of transfer of heat from a body is affected by a covering in two ways. An increase in wall thickness causes an increase of thermal resistance of the insulating material, tending to raise the temperature of the core; at the same time it decreases the difficulty in disposing of the heat produced, as the external surface is also increased. For very small bodies the second factor is the more important, which is said to be the reason that in Nature it is not worth while to heat-insulate with feathers some of the smallest species of birds. Questions have been raised as to the effect on the current loading of paper-insulated cables of the altered dimensions of insulation under B.S.S. No. 480—which superseded B.S.S. No. 7. The Electrical Research Association has found that the two opposing tendencies approximately cancel out. The current ratings of cables for all practical purposes therefore remain as they were under the old Specification.

An Electrical Yardstick

A FRESH example of how electricity can do something far better than can any other method is provided in the proposal of the National Physical Laboratory that it shall furnish the standard of measurement. A standard should ideally be capable of verification at any time in terms of a natural, invariable and easily reproducible unit. Material standards are liable to alteration, apart from accidental damage; thus the present Imperial standard yard is believed to be less by about two ten-thousandths of an inch than when it was legalised in 1856. The accuracy of length determination *in vacuo* in terms of light waves from a cadmium lamp is within a millionth part of an inch in a yard. This has a practical bearing on mass-production methods, which demand interchangeability of parts, and the N.P.L. is often asked to certify master gauges for such work to a hundred-thousandth of an inch.

The Implications of Radium

THE natural interest taken in radium as a therapeutic agent, especially in view of the hope that it may ultimately eliminate the surgeon's knife in the treatment of cancer, has somewhat obscured the wider aspects of the work of the late Mme. Curie. Her discovery of radium started a new era in physics, as the study of radio-activity has opened up new fields for research—all the implications of which are still beyond our grasp—including that into the structure of the atom. Mme. Curie provided sufficient justification for the encouragement of the type of research undertaken without immediate utilitarian end.

More Heavy Plant

WHEN commenting in our issues of May 18th and June 15th on the rapid growth of output this year we showed that if the increase were kept up heavy plant manufacturers must be called upon to meet the additional load. The figures for last month show that the demand is being well maintained. The Central Electricity Board has plans for coping with an additional 500,000 kW by installing generating sets and boilers in several selected stations, which will involve a capital expenditure of between £4 million and £5 million. Particulars are given elsewhere of the first instalment. A rough calculation will show that the Board's expectations are by no means extravagant, and that further orders of a similar kind may be looked for in a not-too-distant future.

The Drought

THE official injunction to "Use Less Water" causes wry smiles in many rural areas, the inhabitants of which are unable to economise in what does not exist. Probably quite six million people are still without an adequate supply of good water. The cost of pumping rather than a real lack of water below the surface has been the chief difficulty. Advantage should be taken of the present opportunity to press the claims of automatic electric pumping. A substantial proportion of the financial assistance which county councils are empowered to give rural district councils for establishing water supplies, and the million pound fund established by the Government for the same purpose, should come the electrical way. Some valuable information, technical and economic, is given in a new E.D.A. report, "Water Supplies and Sewage Disposal in Rural and Small Urban Districts." The particulars given of results achieved are decidedly convincing.

STAGES IN COOKER CONSTRUCTION

The B.T.H. Factory, Rugby (See page 41)

1. The shot blasting installation in the enamelling department. 2. The egress end of the drying ovens. 3. The vitreous enamelling shop pickling plant. 4. Frit-grinding mills. 5. A hydraulic undersand frame moulding machine. 6. A testing bay in the assembly shop

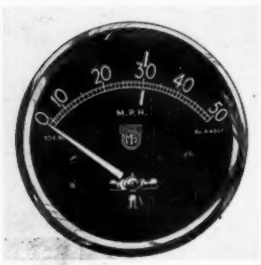
Electrical Speed Indicators.

By E. H. W. Banner, M.Sc., A.M.I.E.E.

A comparison of systems

THE great advantages of the electrical over the mechanical speedometer are the extreme flexibility of the drive and the ease of operating a number of indicators, a pair of wires replacing a tube housing a revolving spindle. Recently electrical methods have become more popular on account of improved accuracy and the development of instruments of various types and sizes. The latter has tended to increase the scope of speed measurements for all forms of industrial use. A central point may have a number of such instruments reading speeds, &c., of machines in various parts of a factory, in addition to local instruments which may be of large size for more distant observation.

The electrical scheme consists of an a.c. or a d.c. generator driven by the moving member the speed of which is to be measured, coupled to a voltmeter which may be in any position relatively to the generator. The d.c. scheme was universal at first, but now the advent of good a.c. instruments has extended the scope. D.c. is likely to remain for the best accuracy, other advantages being the linear scale and so the possibility of reading speeds as low as can be marked on it—one or two per cent. of full scale. On the other hand the usual generator has the disadvantage of brushes, the friction of which may be troublesome on lower-power drives. The generator is of the permanent-magnet type with revolving armature and has a linear speed-volts characteristic which in conjunction with the linear scale of the voltmeter provides a linear speed scale. Normally a scale angle of about 120 deg. is used, but the "Cirscale" has a scale of nearly 300 deg.



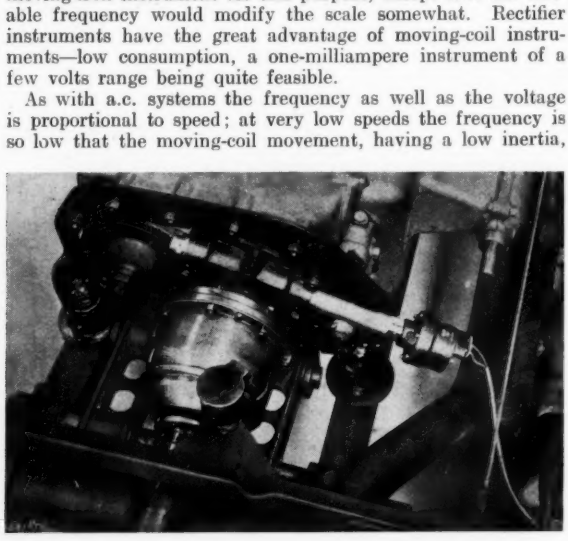
Speedometer with luminous pointer and figures (S. Smith & Sons)

Advantages of A.C.

The great advantage of a.c. systems is the absence of moving contacts as an inductor alternator with a revolving permanent magnet and stationary windings is always used. Brush friction is thus entirely avoided; the usual advantages of a.c. transmission hardly apply as the length of leads between generator and indicator is rarely such as to necessitate a high voltage.

The indicating instrument in practice is one of two types, rectifier or moving iron, but the recent advent of small induction instruments for electrical measurements may extend to this class of work in order to obtain a long scale without gearing; their characteristics approximate to those of the moving-iron instrument for this purpose, except that the variable frequency would modify the scale somewhat. Rectifier instruments have the great advantage of moving-coil instruments—low consumption, a one-milliampere instrument of a few volts range being quite feasible.

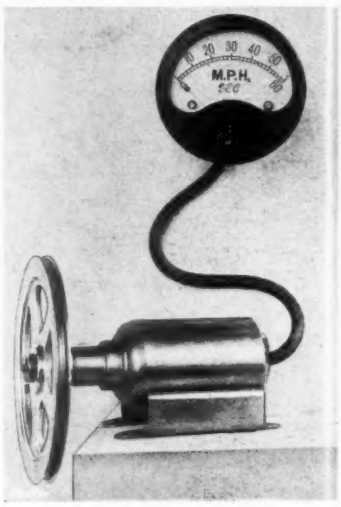
As with a.c. systems the frequency as well as the voltage is proportional to speed; at very low speeds the frequency is so low that the moving-coil movement, having a low inertia,



Generator for luminous pointer and figures mounted on chassis (S. Smith & Sons)

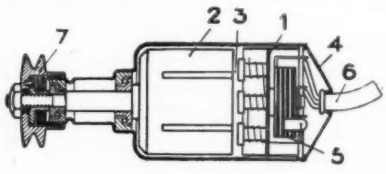
tends to follow the frequency so that pointer vibration may become serious. The price is greater than that of the moving-coil type as the cost of the rectifier is additional.

An intermediate scheme is to use a magneto generating a.c. so as to obviate the use of brushes and to rectify by a static rectifier, such as the copper-oxide type, instead of a mechanical commutator. The rectifier being contained in the generator case the remainder of the system is d.c. Whilst the moving-coil instrument is more expensive than a moving-iron one, the resulting load on the generator is lower, so that the difference in cost can be set against the difference in generator cost due to the smaller size. In the general arrangement of the generator shown, 1 is the housing carrying the fixed coils and adjustable initially for calibration by varying the air gap (3); 2 is the permanent magnet rotor; 4, the end cap containing the full-wave rectifier (5); 6, the leads to the indicator; 7, the pulley. The rotor runs in ball bearings and the overall size is about 3½in. long. This is the General Electric Company's system.



Generator with rectifier (G.E.C. system)

The moving-iron instrument is the cheapest and with modern instruments the accuracy can be nearly equal to that of the moving-coil. Its consumption is greater and so it needs a larger generator than either of the other instruments; but as a satisfactory voltmeter can be made for about 0.5 to 1 W the load on the generator is still very small. The scale characteristic is usually modified so as to be nearly linear from about 10 per cent. of full-scale deflection so that for road vehicles running at 50 or 60 m.p.h. the lowest mark is at 5 m.p.h. This is quite low enough for the purpose and even if the scale would show lower readings they would be useless owing to pointer vibration at the low frequency.



The generator of the G.E.C. system

For road vehicles where the better accuracy and flexibility of drive of the electrical system are justified, the inductor generator and a moving-iron instrument form about the most satisfactory combination, taking costs into account as well as performance. As frequency is proportional to voltage, owing to the possibly bad wave-form it is desirable to calibrate the voltmeters on the same type of generator as that on which they will be used. The voltmeters are then interchangeable, if the generators are initially adjusted.

For vehicle use the generator is commonly made of a size that can replace a mechanical speedometer so that conversion to electric drive is easy. Also for this class of work it is usual to provide a black dial and white or luminous marks.

For stationary work the slight extra expense of the d.c. system is often justified and the use of the a.c. magneto generator with a self-contained rectifier is often better, and certainly cheaper, than the d.c. generator with commutator. The absence of revolving contacts is essential for low-power drives.

Although the load of a single small moving-iron instrument is about 0.5 to 1 watt, and so very small if several indicators are to be run, the sum of the loads may preclude the system, as a much larger generator would be required. On the other hand, the d.c. instrument may be anything up to about 12 V, 1 mA, so that a 1-W generator could run about 100 or more indicators of small size or several larger instruments such as illuminated sectors.

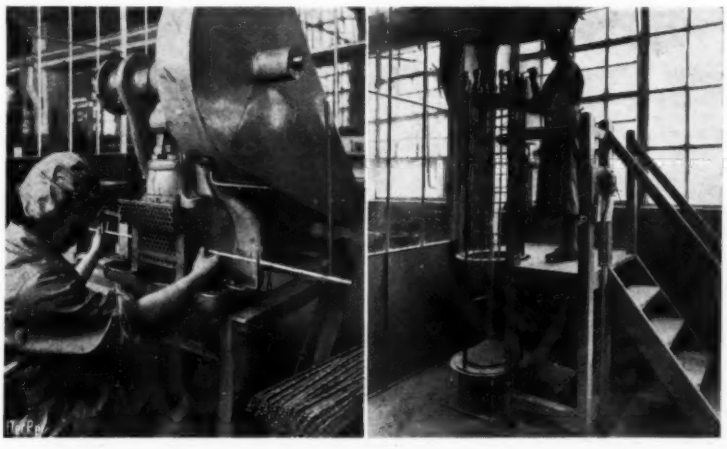
To summarise the advantages, d.c. and moving-coil instrument is best for accuracy, slow speeds and long leads; a.c. with rectifier and moving-coil instruments requires only a small and cheap generator and gives good accuracy with long leads; a.c. with rectifier instrument with small and cheap generator is suitable for long leads; a.c. with moving-iron instrument is the cheapest and is good for single point indication with moderate distances.

MAKING COOKERS AT RUGBY

DURING a recent visit to the domestic appliance factory of the British Thomson-Houston Co., Ltd., at Rugby, to see the manufacture of cookers for the Hotpoint Electric Appliance Co., Ltd., we were interested most in the vitreous enamelling and in the production of "Torribar" elements; in the former because of the exacting control over all the processes, and in the latter because of the unique construction. But probably the most useful purpose will be served by describing the various stages of cooker manufacture as we observed them as far as possible in the correct sequence.

The hob, front, oven and grill doors, legs and the grill and hot-plate castings, are produced in a very up-to-date foundry. Instead of putting the pattern into the moulding box and ramming sand in, the pattern is pushed into the sand on hydraulic undersand frame moulding machines which result in a three-fold speeding up of production. The pattern is placed in a frame on the machine, the box being put on top of the frame and sand filled in to the top level of the box. A movable head is then brought over the box, and against it the pattern is pushed up from below into the filled moulding box. Two of these machines will produce about 120 complete sets of cooker castings per week.

After the two parts of any one mould are put together, the box is placed on a roller gravity conveyor system on which it is carried round to the cupola furnaces and "poured" while still on the conveyor. The moulds continue along the roller conveyor to the "knock-out," where they are vibrated by a small shaker arrangement, so that all the sand falls through to a belt below, the castings being held on a grid. The belt conveys the used sand to a preparing plant, and the sand is then elevated to overhead hoppers for refeeding. Before leaving the foundry all the castings are subjected to shot blasting for rough cleaning, on a rotary-table machine, and then to various fettling operations such as hand dressing the edges, machine grinding and filing, and, finally, inspection.



Left: Press swaging element tubes. Right: Filling the tubes with magnesium oxide

Electric welding is employed extensively, and we saw seam welding and intermittent and continuous spot welding applied to inner and outer ovens. The pull-out oven wrapper is seam-welded, and the back and the rim are then secured to it by intermittent spot welding. The outer oven is of all-welded construction, including the fixing of all such auxiliary fittings as element supports, &c., which provides a very substantial shell, able to withstand rough usage.

The Enamelling Department

To get the enamel to "grip" the castings it is necessary to roughen up the surface, and this is done by shot blasting in a similar way to that in the foundry. Shot is forced on to the castings in a compressed-air stream at about 60 or 70 lb. per sq. in., the shot-blasting cabinet being served by an air receiver which is supplied from the factory power house. Under the blasting table is a screw conveyor which carries the shot to one end of the machine for elevating to the receiver again.

Sheet-iron pressings in various forms, mostly with right-angle bends, shaped on ordinary press-type machines, have first to be freed from grease, and there is a particularly fine degreasing installation. Pickling tanks are arranged in their correct sequence of operations, namely, degreasing (alkali cleaner) washing, pickling (sulphuric acid) washing, neutralising (soda ash and borax), and drying (hot air), in a separate housing about 50 ft. long and 12 ft. wide, with inspection windows, an air-extraction system, and an overhead crane which is operated from the outside. The crane dipping basket and lifting beam are constructed of Monel metal. Much importance is attached to this process, to which the oven and grill door panels, inner and outer ovens, side and back plates, and the splash plate are subjected.

There are up-to-date spraying equipments, but a good deal of the enamel is applied by swilling; we were told that such awkward parts as the oven interior can be given a more even coat by the latter method. After draining, and, where necessary, mottling by low-pressure spraying, the treated parts are passed on continuous conveyors through drying ovens which are heated to about 100 deg. F. at the feeding end and 180 deg. F. at the discharge end. Each drying oven is about 34 ft. long, and the average time for parts to travel from end to end is about 30 min. These spraying, swilling and drying operations are all carried out in one room in which a slight pressure above normal is maintained by blowing in 16,000 cu. ft. of air per min.

As applied, the enamel is really glass suspended in water, and its preparation is of particular interest. Frit, the basic material, has to be carefully selected to ensure the same coefficient of expansion as that of the metal. It is mixed with clay for suspension, and oxides for colouring, and ground in porcelain-lined mills charged with porcelain pebbles. The mills are individually motor-driven slowly through reduction gear and the grinding operation usually extends for about four hours, after which the enamel is drained off into a "Roto-spray" centrifugal machine in which it is forced through a Monel-metal gauze. There is a portable structure with elevating and tipping gear for loading the mills.

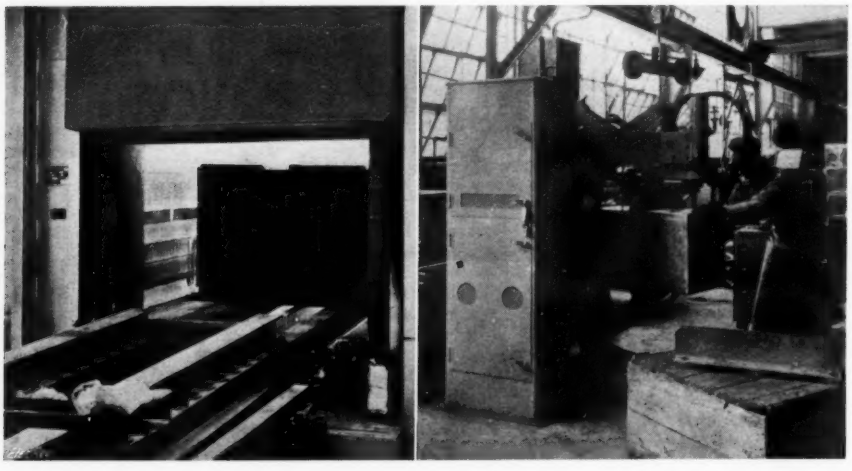
The firing of the enamel after drying is effected in a large furnace 12 ft. long, 4 ft. 8 in. wide and 5 ft. high. It is loaded at 250 kW, and the heating system is arranged in two zones. In the first zone 80 kW is distributed over the first 2 ft. at the front, and the other 170 kW is distributed over the other 10 ft. Each zone is separately controlled, both electrically and by pyrometers. The door is electrically operated.

Enamelled sheet-iron is treated at 860 deg. F. for about 5 min. for the ground coat, and at about 830 deg. F. for the white coat; subsequent coats are treated at still lower

temperatures. Cast-iron enamelling, merely because of the difference in the nature of the enamel, is fired at only 740 deg. F. for about 15 min. Very great care is taken of all the enamelled parts, and when they are removed from the furnace after cooling they are put in special wooden frames, in which they remain during storage. They are taken to the storage area on roller conveyors.

The Production of "Torribar" Elements

For the "Torribar" elements stainless-steel tubes are first annealed and chemically treated. The ends are then counter-bored, and the interiors rifle brushed, rendering them ready to receive the element spirals. These are constructed from 80/20 bright nickel-chrome wire, wound on a mandrel on a machine fitted with special throw-over supporting guides for the spiral. Threaded pure-nickel rod is screwed into each end of the spiral. Careful resistance testing of the spiral is effected before assembly in the tubes. The spiral in each tube is held slightly under tension by clover-leaf washers which are clamped into a groove in the nickel rod and fit in the counter-bored tube end.



Left: A vitreous enamelling furnace. Right: Intermittent spot welding of a cooker oven in a machine with thyratron control

The flexible spiral is maintained along the centre line of the tube in an ingenious way. The tube with its spiral in position is crimped or indented at regular points along its length, the crimps being arranged in pairs in opposition, with alternate pairs at right angles to their neighbouring pairs. The crimped tubes are then arranged in a special frame something like the vertical wires in a circular bird cage, and hot magnesium oxide is poured into the tubes through special funnels at the top.

During filling the tubes are constantly subjected to spring-influenced tapping by a simple rotating arrangement within the cage, so as to ensure uniform packing of the magnesium oxide and to prevent voids. Pinching the tube ends outside the washers then results in a sealed tube tightly packed with oxide.

In a press-type machine with special half circular tools the crimps are removed and the diameter of the tube is reduced. The tubes are then reduced in a rotary swaging machine from 0.375 in. to 0.315 in. diameter, and in consequence the magnesium powder is compressed to solidity. The swaging may be done in more than one operation between heat treatments for the annealing of the tube only; the heat treatments have no effect whatever on the magnesium oxide. The ends of the tubes are then cut back by a revolving grinding wheel which travels round the tube so as to leave a portion of the nickel rod or terminal exposed. The completed tubes are bent to shape on special bench formers by special tools fitted with rollers.

We saw several varieties of such bending machines, each designed to produce a particular shape of element. The ends of the formed tubes are then brazed to terminal boxes, and steatite bushes are put on the ends of the tubes; brass collars are brazed on and nickel bunch wire is secured to the nickel rod. The terminal boxes are then fitted with covers and sealed with cement. Placing beads on the bunch wires then completes the formed unit ready for assembly.

Assembly

The assembly of the manufactured parts is effected on the conveyor principle, each cooker being gradually built up on a continuous line. Auxiliary assembly operations such as bus-bar construction are carried out on side benches, and here and there one sees "tee-offs" on the conveyor around which three girls can work. It is unnecessary to describe the whole sequence of assembly in detail, and we propose therefore to refer only to a few of the major operations.

For securing the fronts of the ovens to the frames, plated bars are first bolted to the turn-over edges of the oven. For the "de-luxe" types of cookers pure asbestos lagging is applied to the ovens before assembly in moulded form, the mouldings being secured by cadmium-plated strapping. For other types of cookers slag wool is rammed between the inner and outer ovens in a separate chamber built in the conveyor line, the slag wool being chute fed from an overhead hopper. At one stage of a line we saw a small section of the conveyor separated from the rest and fitted with a circular frame in which a cooker can be clamped and turned over bodily from front up to back up, somewhat after the style of a railway-truck tippler.

Another important stage in the conveyor system is the test bay—a three-working-sided structure equipped for load, "Megger," and flash tests. One particularly important part of the testing work is the thermometer calibration, for because of additional heat loss from, and convection currents near, the oven door the thermometer cannot read directly the true oven temperature upon first heating. On test the oven door thermometer calibration is checked by means of thermocouples placed in the middle of the cooking space. It follows that the door thermometer lags behind the true oven temperature during heating and cooling, but gives a true indication when the oven temperature is steady.

An Electrically Driven Pumping Station

AN example of the economy which may be effected by the installation of electric drive in waterworks is the Desford pumping station of the Leicester water works, which until about three years ago was operated by two semi-Diesel engines. When extra duties necessitated increased power it was decided to install an electric motor, which now drives a Worthington-Simpson centrifugal pump, the old engines and pumps being retained as a standby. Previously three men working in shifts were required, but it is now necessary to have only one man in charge of the station, which represents a considerable economy in labour charges.

The water is brought to the Desford pumping station from Thornton reservoir, some three miles away, and is then pumped to the Tuttle Hill reservoir, Nuneaton, a distance of fourteen miles, through a 14-in. pumping main. Water is also taken off the pumping main *en route*, at Hinckley. The pump boosts the water from a pressure of 50 ft. on the suction side to 295 ft. on the delivery side, the water horse power being 71. Approximately 57,500 gallons of water is pumped per hour against a 245-ft. head.

The quantity of water pumped is measured by a Kent venturi water meter, and in the delivery main is a Gent pressure gauge, which in the event of a burst main or power failure will give the alarm at the attendant's house adjoining the pumping station. The gauge is arranged so that when the finger falls back contact is made to a relay which operates the alarm bell; with the aid of this safety device it is not considered necessary to keep a man continuously in attendance inside the station.

The motor driving the pump is of the "No-lag" power factor correction type manufactured by the British Thomson-Houston Co., Ltd., and rated 150 h.p., 50 cycle, three-phase. 1,480 r.p.m.

In addition to the saving realised in labour charges the power factor improvement effects considerable economy in the power charges. The motor has been in continuous service ever since it was installed three years ago, and it is now operating ninety-four hours per week on an average. An illustration of the plant installed at the Desford pumping station appears on page 51.

Factory Switchgear. By J. O. Knowles, M.A.*

The question of rating

THE definite attitude of the supply authority engineer regarding the rupturing capacity of his distribution switchgear is in contrast to the somewhat indefinite attitude of both users and manufacturers of low-voltage switchgear, fuses and starters. For public supply, a rough calculation at least is made to determine the possible short circuits that may be expected before issuing an inquiry. Thus, for 6,600-V sub-station switchgear, a rupturing capacity of 150,000

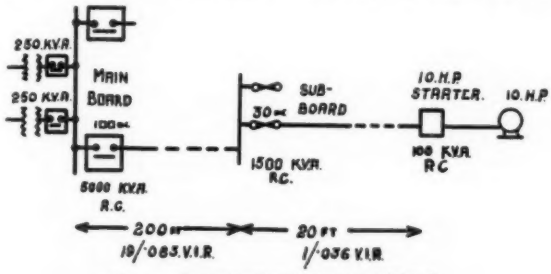


Fig. 1.—Distribution layout criticised

kVA may be specified for usual situations, this being reduced to, say, 75,000 kVA where there is considerable feeder resistance, and increased to 250,000 kVA at main sub-stations or to, say, 500,000 kVA on large power station busbars. Detailed calculations of short-circuit power are often made, taking into consideration all generator reactances, transformer reactances and feeder impedances. Controversy may still rage as to margins of safety, power factor, fortuitous arcing, test results and arc control, but in practice the switchgear is specified and ordered for definite arithmetical figures of rupturing capacity in kVA.

The Specification of Rupturing Capacity

For factory distribution, the attention paid to rupturing capacity has so far been chiefly evident in the following forms: 1. The idea has been frequently but indefinitely expressed that the growth of distribution and the advent of the grid will increase the possible short-circuits on power consumers' premises. 2. There have been more frequent requests to manufacturers "to state the rupturing capacities" of industrial circuit-breakers, fuses, and motor starters. 3. Manufacturers, in particular those offering cartridge fuses, have published rupturing capacities and given some attention to the increasing short-circuit powers of factory distribution.

Taking these chief tendencies in turn:—(1) The national grid has very little effect on the short-circuit power available in most factories. Although the grid switchgear is standardised for 1,500,000-kVA rupturing capacity, the number of factories where more than 25,000 kVA is available on the 400-V supply is still very small. In general, 1,000 kVA of transformers must be concentrated on one set of busbars to produce a short-circuit of 25,000 kVA, even with infinite power behind the transformers, which act as a choke on the power available on the primary side of the transformers.

For fuses of a normal carrying capacity of 30, 60 and 100 A, the short-circuit ratings are 2,000, 4,000, and 6,500 A, respectively, and 1,400, 2,750, and 4,500 kVA. The rupturing capacities of cartridge fuses, on the other hand, are as high as 25,000 kVA for one fuse on 400 V, or 40,000 kVA for three fuses on a 400-V three-phase supply. The contrast should be noted between a commonly accepted standard equivalent to 4,500 kVA for a 100-A rewirable fuse and a value of 40,000 kVA for cartridge fuses.

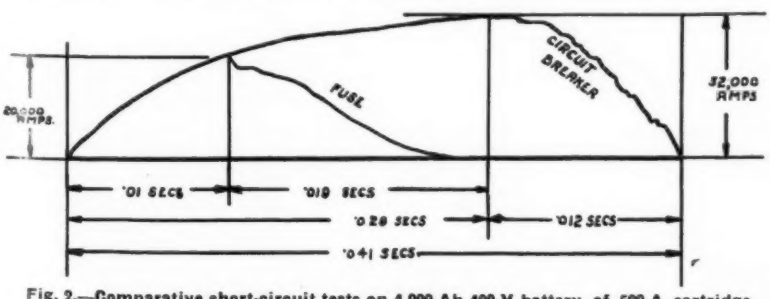


Fig. 2.—Comparative short-circuit tests on 4,000-Ah 400-V battery of 500-A cartridge fuse and d.c. circuit-breaker set at 1,500 A

It is not usual to claim more than 25,000-kVA rupturing capacity for low-voltage circuit-breakers up to 300 A, and smaller sizes of light construction have a much lower limit of safe operation. For motor starters it is common to claim only that the starter will open circuit successfully on four times full-load current for d.c. starters, and six times for a.c. starters. On this basis, a 100-h.p. starter on a 400-V three-phase supply would have a rupturing capacity of about 700 kVA and a 10-h.p. starter one of about 70 kVA.

If, then, a 100-kVA 10-h.p. starter is connected through rewirable 30-A, 1,500-kVA fuses, to a 5,000-kVA main distribution circuit-breaker fed from two 250-kVA transformers capable of giving a combined short circuit of, say, 10,000 kVA, can the installation be considered satisfactory? (See fig. 1.)

In the first place, a fault between the fuses and the main breaker will cause only the latter to open. If the short-circuit is between one phase and earth, the first current will probably be limited by the resistance of the connection between "earth" and the neutral point of the transformer, through which it must return. Earth plates have often a resistance of two ohms, sufficient to reduce the possible current at 200 V above earth to 100 A, which may not trip a main breaker not fitted with leakage trip; if the accidental earth is to some metal not bonded to the neutral point, the earth resistance may be higher than this.

It is more likely that an accidental earth on a main cable or on terminals or other switchgear conductors will be to some metal properly bonded to the earthed neutral. In this case the short-circuit current will be limited only by the possible supply (assumed above to be 10,000 kVA) three-phase or 3,300

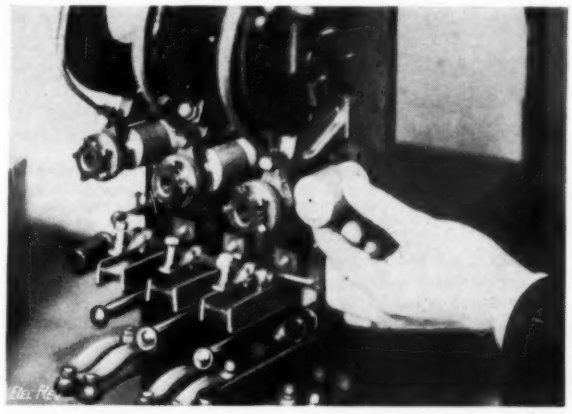


Fig. 3.—Cartridge-fuse protection in Brookhirst starting panel

kVA from one phase to neutral and by the resistance of the earth bonding. If the latter is of the order of 0.01 ohm (or the resistance of 100 yd. of ½ in. by $\frac{1}{16}$ in. copper strip) the resistance limitation to the fault will be comparable to the reactance limitation. The power factor of the fault will then be of the order of 0.5 lagging instead of, say, 0.1 lagging, and this will be more favourable for arc extinction.

Nevertheless, earth faults often start at or near exposed terminal points where, more especially in the case of low-voltage circuits, only air insulation exists and where an arc to earth immediately involves all phases. I do not know of any investigations that have been made into the relative speed of l.v. breaker operation and the spreading of faults to other phases. Practical experience of closing on a fault that starts on one phase and spreads to others shows that the stress may be almost entirely on the phase on which the fault commences.

Further, in testing for short-circuit rating, the fault is created by a very substantial connection to earth (or between phases), whereas in practice the fault often commences with a gradual breakdown in insulation. This tends to make the onset of the short-circuit less sudden, and may ease the stress on the circuit-breaker, although I have no exact data on the subject. Even with bolted connections and a battery capable of supplying a peak of 30,000 A, tests have shown that it takes 0.03 sec. for the current to reach this value and only the same time to break the battery circuit by a fuse, but that it takes

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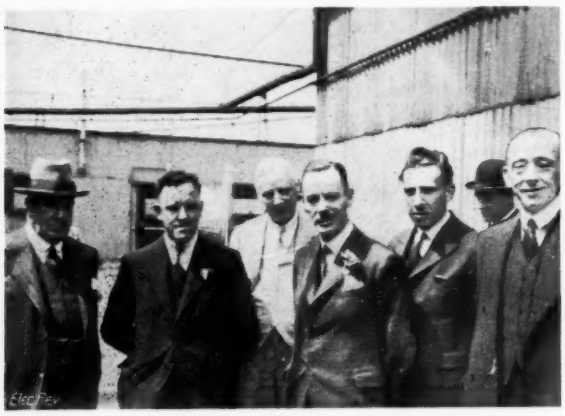
0.04 sec. to open the circuit by a circuit-breaker from start of short-circuit to extinction of arc. (See fig. 2.)

Finally, although two 250-kVA transformers would give approximately 10,000-kVA short-circuit with infinite power on the high-voltage side, this value would probably be reduced by h.v. feeder impedance and even by e.h.v. transformer or generator reactance to 7,000 kVA or even less. Thus, a main circuit-breaker, having a 5,000-kVA breaking capacity, might be satisfactory for a considerable period on a supply from 500 kVA of transformers having 5 per cent. reactance (*i.e.*, 10,000 kVA possible short-circuit). On the other hand, it might not. The first time a circuit is closed on load is as likely to produce a dead short-circuit as any other; cables are sometimes crossed between phases and other installation faults do happen. Further, with growing loads, the main transformers may be soon replaced by larger ones having higher short-circuit capacity. For main circuit-breakers on the l.v. side of transformers, I would, therefore, recommend an ample margin of rupturing capacity—a value at least twenty times that of the normal capacity of the transformers feeding the circuit.

Next consider a fault between the starter and the sub-circuit fuses, which were for illustration considered to be of 30-A



Members of the South Midland Centre, I.E.E., visit Callender's works at Erith. From left to right: Messrs. Barnard, Hooper (hon. sec.), Coxon (chairman), Callender, Rawll, and Hunter (President I.E.E.)

size with 1,500-kVA rupturing capacity. If the cable from the sub-circuit fuses is designed to carry 20 A (say 7/0.036 v.i.r.), then about 100 ft. of this cable would have sufficient resistance to reduce the fault current to the equivalent of the 1,500-kVA three-phase rupturing capacity of the 30-A fuses. If the cable between the main breaker and the sub-circuit fuses were of about 100-A capacity (say 19/0.083 v.i.r.), then 1,000 ft. of this cable would be required to limit the short-circuit to 1,500 kVA if the fault were just adjacent to the load side of the sub-circuit fuses.

Cable Resistance Limitation

These figures are given independently of the impedance of the h.v. cables, transformer and l.v. cables to the main board, the impedance of which on a short circuit of 1,500 kVA would be small. A greater easement of the stress on the fuses would be due to the likelihood of the dominant limitation of the short circuit being cable resistance, not transformer reactance. As the power factor of the short-circuit will, therefore, be fairly high, the fuses (if rated to clear 1,500 kVA at low power factor) would probably clear a considerably higher value at high power factor. It is likely that the shortest length of cable between main breaker and sub-circuit fuse board will not exceed 200 ft., and between starter and fuseboard 20 ft., and the combined resistance of these cables would limit the short-circuit to about 3,750 kVA, which might again be reduced to, say, 3,000 kVA by impedance in the main supply. The fuse might not clear this value, and a fault adjacent to the fuseboard terminals might cause an explosion.

A 30-A fuse blowing on a heavy short circuit of, say, 3,000 kVA will probably clear in 0.002 sec. If it does not clear in this time, it may continue to arc over and fail to clear at all. Now the main circuit-breaker will probably not begin to open for 0.02 sec. and not clear in a total time under 0.04 sec., which is twenty times as long as the time in which the fuse should blow. It is, therefore, hardly correct to say that a main circuit-breaker will assist a sub-circuit fuse to clear a serious fault. (I agree that on much smaller faults a circuit-breaker sometimes opens before even a more lightly rated fuse.) A sub-circuit fuseboard near the main switchboard might be dangerous under the quite ordinary assumptions made above.

Should a short-circuit occur between the motor and the starter (in the example taken), a rupturing capacity of 100 kVA will probably be considerably less than the short-circuit which can be fed into the starter. Even for 5-A circuits, a length of 400 ft. of 3/0.02 v.i.r. would be required to reduce the possible three-phase short-circuit to 100 kVA on 400 V. On larger cables, it would be quite impracticable to reduce the possible short-circuit to such low values. The salvation of the starter of low rupturing capacity on the few serious short-circuits which it may have to bear during its lifetime is probably the rapid action of the fuses behind it. Should the short-circuit not be sufficiently severe to blow the fuses before the starter contacts open and the fault be still beyond the rupturing capacity of the starter, the latter may be damaged before the fuses clear. If the protection behind the starter is in the form of circuit-breakers and not fuses, the longer operating time of the former may cause greater damage.

The possible short-circuit value cannot be worked out for each individual sub-circuit, though the small number of serious faults which occur in practice are worth investigating in terms of the numerical value of the short-circuit which has probably occurred. Except in the larger factories the immediate problem is not serious, and the risks taken are not so disastrous in practice as might be expected. Nevertheless, as the plant installed in the last few years becomes older and more liable to faults, and as the growth of distribution concentrates heavier transformers in factory sub-stations, the risks taken with existing plant will in some cases involve replacement before the distribution gear would otherwise be reconstructed.

Effects of Extra Fault Current

In making tests to destruction, it is noteworthy how a little extra fault current at the limiting rupturing capacity can make all the difference between a normal opening of the circuit (with little signs of stress or damage) and an alarming and disruptive failure resulting in very considerable damage. Other conditions, such as recovery voltage, also affect the limit of satisfactory operation. As the currents given above for serviceable fuses are commonly obtained from a battery, it should be stated that, in general, fuses have a higher rupturing capacity on a.c. than on d.c. It is difficult to give any relative values, especially as the power factor of the a.c. supply and the point of the voltage wave at which the short-circuit commences vary in different a.c. tests.

For a conclusive result with a.c. a number of tests must be taken and the conditions standardised; for instance, the test should be made close to the l.v. terminals of a transformer whose reactance will just permit the rated short-circuit to pass. (The supply is assumed to be so large that its impedance is negligible, and the short cables between the tested unit and the transformer are assumed to have negligible resistance to the short-circuit.) Such a test is, in the present standardisation of a.c. supply, more related to working conditions than a test from a d.c. battery. A 500-kVA, 6,600/400-V transformer would be sufficient for three-phase tests on the usual limits of l.v. short-circuit values of, say, 5,000 to 10,000 kVA.

Rupturing capacity is more important in the larger sizes of starters, fuses and circuit-breakers than in the smaller, and the limiting resistance of cables is less important. In small sub-circuits, a fault may more easily blow itself clear, part of the cable or wiring acting as a fuse and burning away sufficiently to interrupt the circuit. (I have seen on short-circuit tests of a few thousand amps. the whole of the copper in several feet of cable expelled from the ends, leaving nothing but soft rubber and braiding remaining.) On circuits of larger normal amperage, the robustness as well as the short-time carrying capacity of the cables calls for adequate rupturing capacity at any point where the fault is likely to be interrupted.

Summary of Conclusions

My conclusions may be summarised as follows:—

1.—The short-circuit ratings of industrial switchgear, fuses and starters should be more definite, and on a three-phase kVA basis for a.c. systems.

2.—The rupturing capacity of any distribution gear on a main switchboard should not be less than twenty times the normal kVA capacity of the transformers feeding the switchboard.

3.—Unless distribution cables within the factory are very long, the normal rupturing capacities of fuses and starters may be inadequate, either now or as transformer capacity is increased.

4.—The range of rupturing capacities between 5,000 and 10,000 kVA will be more important in future in relation to fuses and starters.

5.—Fuses operate more quickly than circuit-breakers on heavy short-circuits. Starters protected by heavy distribution switchgear only may be severely damaged before the circuit-breakers clear. Starters can be made safe against even very heavy short-circuits by suitably proportioned fuses.

Electric Heating in an Ancient Church

THE building of the church of St. Mary, Beverley, was started in the first half of the twelfth century and completed in the year 1524, after the fall of the original tower. Fragments of an earlier Norman church still remain, and the nave, chancel and tower of the present church are built upon its foundations. Previously, the heating was provided by five coke stoves, which were about eighty years old, placed in corners of the church. Fuel was brought along the aisles in wheelbarrows, and immediately after stoking the church became full of fumes.

This system has been displaced by an electric heating installation consisting of approximately 170 kW of tubular elements, and 10 kW of "Morganite" panels, and during the past winter the consumption of electricity amounted to over 100,000 kWh. Tubular elements are fixed under all pews in the nave and aisles, and are built up in banks at points where the radiation losses are greatest. The heating is usually hand-controlled, but provision for control by time switches and master thermostats has been made. The installation was designed to raise the temperature from 32 deg. to 55 deg. F., in approximately three hours.

The unique roof of the chancel contains forty panels, each of which represents one of the early English kings. A Latin inscription records the king's name, the length of his reign, and his burial place. The misericords of the chancel stalls bear exquisite carvings illustrating the life, religion, sport, and costumes of the early fifteenth century. A section of the "Morganite" panels has been made up into two lighting and heating units, which are suspended from the centre tower over the choir; the remaining panels are mounted behind the chancel screen.

The interior of St. Mary's, Beverley

St. Michael's Chapel, with its miniature English Gothic roof, is considered the architectural gem of the church. The priest's room, situated above the chapel, is now used as a museum, and here relics of the church are preserved. A heavily loaded section (90 W per ft.) has been run under the clerestory windows, and conforms to the stone moulding in line and colour. In the chancel the elements have been concealed by mounting them on the reredos surrounding the high altar and beneath the chancel stalls. The heaters running at the foot of the pillars, which have original Norman bases, do not in any way detract from the architectural line, and are coloured to match the surrounding stone-work.

Electricity from the mains of Hull Corporation is taken to two service positions; one is situated at the west end of the church and covered by oak cupboards; and the second terminates in the base of the north east pier of the centre tower. This arrangement permits the heating to be split up into two sections of approximately 90 kW each, which is balanced on the three phases. An additional advantage of this is that it obviates the necessity of heavy cables being laid in the church. After the installation was put into operation an additional 16 kW of heating was installed in the north and south transepts to counteract heavy radiation losses in the centre of the church.

Supply Change-overs. By E. L. Gethin, Hons. B.Sc. (Eng.)

THE conversion of a non-standard distribution network to the standard a.c. 400/230-V system usually involves complete recabling and the re-equipment of sub-stations with three-phase transformers, switchgear, &c. In most undertakings this is not so serious as may at first appear. The capacity of sub-station plant and cables installed even a few years ago is generally inadequate for present requirements, and the change-over affords an excellent opportunity for modernising the system. As systems have developed, sub-station sites have become far from ideal with respect to the distribution of loads, and the new layout can also be planned to remedy this disadvantage.

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Where the expense of renewal is not justified, existing cables may be rejointed to the new system, particularly with three-wire distribution systems. Two phases and a neutral are thus available and the necessity of installing single-phase motors is avoided. Two-core cables should be allowed to remain only for small loads mainly consisting of lighting. It is usually possible to balance the load on a number of three- and two-core cables so that all three phases are so equally loaded. Perhaps the greatest problem to be dealt with is the modification of consumers' apparatus. This is the liability of the supply authority, and no consumer must suffer any loss due to the change. The variety of apparatus to be modified is truly astounding. It is not usual to alter the supply voltage when changing over. This is unfortunate in many respects, as the voltage may differ from the standard 400/230, but it relieves the supply authority of the enormous cost of relamping all the installations, and generally other non-inductive electrical appliances.

Apparatus requiring consideration includes motors of all types (except the fractional horse-power "universal" series variety), dental and medical apparatus, transformers and wireless gear. Most of the work is in changing motors, *e.g.*, vacuum cleaners, fans, domestic refrigerators, butchers' mixing machines, bakers' dough mixers, and motors for a great variety of industrial purposes. The replacement of motors is not always as simple and straightforward as might appear at first sight. If induction motors are employed for replacement, as they generally are, the speeds available are very limited. The synchronous speeds are 3,000, 1,500, 1,000 r.p.m., and so on. Where the old supply is d.c., the speeds may be almost anything, differing widely from the 50-cycle speeds available. Again, where a non-standard frequency system is being replaced, the synchronous speeds are almost certain to be different from those mentioned.

When the motor drives its load by pulleys and belt, this discrepancy in speeds may easily be adjusted by an alteration in pulley size, but with direct and gear-coupled motors other steps must be taken. Where the motor is direct coupled, as in some organ-blowing equipments and hot-water circulating pumps, it is often necessary to replace the complete unit if a considerable alteration in speed is unavoidable. The alteration in speed in gear-driven machines may be compensated for by fitting new gearing, but a difficulty which occurs all too often is that the maker is either unknown or has retired from business, and thus the necessary parts are not obtainable.

Domestic vacuum cleaners are usually dealt with by the manufacturers; this is by far the most satisfactory method, and the conversions are made under special terms in view of the quantities handled. The conversion of wireless apparatus has its own particular problems; when changing from d.c. to a.c. it is often cheaper to provide the owners of "all-mains" sets with entirely new ones, rather than attempt to equip the old

A Modern Margarine Factory

THE factory recently built at Mitcham by Benninga's British Margarine & Produce Co., Ltd., is designed on the lines of Dutch butter factories and creameries, and consists mainly of a single storey building laid out on the "straight-through" principle. A three-phase, 400-V, 50-cycle a.c. supply is obtained from the County of London Electric Supply Co., Ltd. The whole of the machinery is electrically driven, thirty "Witton" motors and control gear, ranging up to 40 h.p., having been supplied by the General Electric Co., Ltd.

The incoming power is led to a "Salford" line contact circuit-breaker and is divided into five sections, four being controlled by "D.B." ironclad switch fuses and ironclad distribution boards equipped with "handguard" fuses. Raw materials in the form of vegetable oils are melted down in steam-jacketed tanks and then pass by gravity to two vertical spindle temporating churns, or agitators, each geared to a 1-h.p. squirrel-cage motor mounted with its direct-to-line starter on a cross-bar above the tank. The fat is next mixed with milk in jacketed emulsion churns driven through line shafting by a 40-h.p. 950-r.p.m. protected-type motor fitted with a totally enclosing slip-ring cover, and the mixture is poured into a cooling drum connected to an ammonia compressor. The drum is driven through vee-ropes by a 12½-h.p. 955-r.p.m. drip-proof motor of the slip-ring type, with wall mounted contactor starter, arranged for remote control from push buttons mounted on the platform above the drum.

From the cooling drum the margarine falls in flakes into wooden trucks, where it is allowed to stand for a definite time before being raised by a lift to a triple-roller machine which ensures a product of perfectly smooth texture. This machine passes the margarine through wooden rollers and subsequently through two pairs of granite rollers running at different speeds and then removes any excessive moisture by forcing the margarine through a tube by means of a rotating worm. The rollers and the worm are driven by a 34-h.p. 950-r.p.m. slip-ring motor of the protected type. The necessary salt is added on circular rotating kneading tables and mixed in by wooden vanes mounted on a revolving shaft. Two kneading machines are each driven through gearing by a 13½-h.p. 720-r.p.m. vertical-spindle slip-ring motor designed specially for incorporation in the machine. Two other mixing machines are equipped with 12½ h.p. slip-ring motors running at 950 and 1,440 r.p.m.

Left: Automatic packing machinery. Right: Kneading in progress

After kneading the margarine is placed in a large refrigerated store-room with special ventilating equipment and can be withdrawn in bulk for packing as required. High-speed machinery cuts, forms, packs, and weighs sixty packets or rolls per minute, one machine being adjustable to enable different sizes of packages to be produced for special purposes. Four totally enclosed squirrel cage motors of 1½, 2½, 3 and 3 h.p. drive the packing machinery, and are controlled by direct-to-line contactor starters.

Pumps conveying emulsion, fat, milk, and ice water, and for circulating cooling water are driven by squirrel-cage motors of from 1 to 6 h.p., those for the milk pumps being totally enclosed. Automatic contactor starters controlled by push buttons are provided in each case, allowing maximum convenience and accessibility to be combined with correct and safe operation.

Supply Change-overs *(continued from previous page)*

receivers with some form of rectifier. If the mains are employed to provide the h.t. only by means of suitable smoothing equipment, it is economical to replace this with a small self-contained rectifier. These units, complete with chokes and condensers, are obtainable at very low figures when purchased in quantities.

The Reasonable Attitude

Psychology and engineering do not usually have much in common, but the engineer responsible for a change-over must be constantly on the watch for consumers with the "out for something for nothing" mind. There appears to be a class of people who, although reasonably honest in other respects, cannot see anything wrong in defrauding a non-personal body, such as a supply authority, and who consider themselves extremely smart if they are able to benefit at no expense to themselves.

The reasonable attitude is undoubtedly that the consumer should not be penalised in any way by the change of system. In exceptional cases, satisfactory modification cannot be effected, and the best solution is replacement by a new motor or whatever piece of apparatus is in question, but usually rewinding provides a satisfactory and much more economical alternative. Naturally, the supply authority cannot be held responsible for the mechanical condition of any apparatus, but a number of consumers think themselves hardly treated because obsolete and worn-out gear is merely rewound and not replaced by new.

Another aspect crops up in connection with maintenance of plant after a change. It is good policy to make an effort to retain the goodwill of consumers by being generous in this respect. There must, of course, be a limit, and the class of consumer already referred to usually expects free maintenance for all time, and when the worn-out gear finally falls to pieces, change-over gets the blame! The writer has knowledge of a number of instances where consumers have bought second-hand gear at "junk" prices with the full expectation of free replacement at the time of change of supply.

The actual work of changing over is very largely a matter of organisation. A 50-cycle supply must be available at the premises under consideration. Arrangements must be made with the consumer as to the most suitable time to do the work, and finally temporary motors, &c., must be ready and waiting so that the consumer suffers the minimum of inconvenience.

The Public Lighting Conference

The eleventh annual conference of the Association of Public Lighting Engineers is to be held in Aberdeen from September 17th to 20th. The city's public lighting will be inspected, together with special street demonstrations and the floodlighting of prominent buildings. An exhibition is being arranged to illustrate the most recent developments in street lighting, and the annual report will survey progress. An interesting series of papers is being prepared for presentation on several aspects of street lighting, apart from social functions and excursions. Details are obtainable from Mr. J. S. Dow, 32, Victoria Street, London, S.W.1.

The Fuel Returns

THE "Analyses and Summaries of the Returns of Fuel Consumption and Units Generated" for the year ended December 31st, 1933, have been issued by the Electricity Commission (Stationery Office 1s. 6d.). The particulars relate to authorised undertakings, traction authorities, and certain non-statutory undertakings.

Returns were received from 489 generating stations, a decrease of thirty-two from last year; the difference is due to the closing of forty-three stations, the exclusion of Guernsey, to the putting into commission of eight new stations and one stand-by station, and to the inclusion of three existing stations previously operated on a non-statutory basis.

The stations concerned generated 14,964 million kWh, an increase of 9.6 per cent. over 1932, for a fuel consumption of 10.7 million tons, an increase of 4.95 per cent. The 270 steam stations produced 96.04 per cent. of the total. In the remaining stations water power was responsible (fifty-three stations) for 2.21 per cent., waste heat or gas (11) for 0.82 per cent., oil engines (157) for 0.51 per cent., gas producers, refuse and town's gas (41) for 0.42 per cent., each of these groups showing a decline from the previous return; several of the stations included more than one type of prime mover.

The Ironbridge station of the West Midlands J.E.A.

The average coal consumption per kWh in the steam stations was 1.65 lb. per kWh generated (1.74 lb. in 1932); the figures ranged from an average of 1.41 lb. at those producing over 200 million kWh, increasing with diminishing outputs for the twelve groups to 7.41 lb. at stations with an output of less than 50,000.

The premier position both in fuel consumption and thermal efficiency on the year's working was taken by Clarence Dock (Liverpool) with 1.12 lb. and 26.06 per cent., which generated 276 million kWh at a load factor of 56.8 per cent., although Portishead (Bristol) with 21.59 per cent. lowered its fuel consumption from the 1.15 lb. with which it secured first place last year to 1.13 lb. The new stations at Ironbridge (W. Midlands J.E.A.) and Battersea (London Power Co.) returned percentage thermal efficiencies of 26.84 and 26.15 respectively for a portion of the year, while Blackburn Meadows secured 23.4 and Dunston (50-cycle) 21.18, the last named under dual-frequency conditions.

Other stations (22) which maintained their efficiencies at over 20 per cent. were: Hams Hall (Birmingham), 22.93; Brighton, 20.78; Barking (County of London Co.), 23.09; Longford (Coventry), 20.67; Spondon (Derby & Notts Co.), 23.56; Portobello (Edinburgh), 22.24; Kearsley (Lancs. E.P. Co.), 23.62; Kirkstall (Leeds), 24.23; Lots Road (London Passenger Transport Board), 21.15; Deptford East, 20.34, and Deptford West, 24.28 (London Power Co.); Barton (Manchester), 21.42; North Tees (North-Eastern Supply Co.), 21.18; Brimsdown B. (Northmet), 22.10; Chadderton (Oldham), 20.40; Ferrybridge, 21.98, and Thornhill, 25.42 (Yorkshire E.P. Co.). Stations included in the 20 per cent. list for the first time were: Clyde's Mill 20.28, and Yoker 20.75 (Clyde Valley E.P. Co.); Croydon, 20.62; Hackney, 21.67; and Neasden (London Passenger Transport Board), 20.28.

Twenty-five oil-engine stations attained thermal efficiencies above the Clarence Dock figure. The Yeovil Co.'s station came first with 30.64 (the figure achieved by Buxton in 1932 when it secured first place; it was second last year with 29.89). Ashford, Alderley, the Charing Cross Co. at St. Martin's Lane, and at Short's Gardens, Cromer (East Anglian Co.), East Retford, Epsom, Frinton-on-Sea, and Market Drayton Co. all put up over 28 per cent. The best gas producer station was Leek with 12.61 per cent., but Bridgwater used least fuel per kWh, 1.92 lb.

Apart from the stations mentioned, Padiham (Lancs E.P. Co.), although second to Chadderton in its thermal efficiency (19.79) for the group generating between 25 and 50 million kWh, had the lowest coal consumption, 1.42 lb. Bonnybridge (Scottish Central E.P. Co.) secured first place on both counts in the 10 to 25 million group with 19.79 and 1.58. Non-selected stations that achieved first place in their groups and made a good showing considering their sizes were the Salisbury Co. (5 to 10 millions) with 15.09, Whitehaven (2.5 to 5 millions) 17.26, in which group Darwen used least fuel with 2.12 lb. and Inverness Corporation (1 to 2.5 millions) 16.8.

The Battersea power station (London Power Co.) from a new angle—the top of the neighbouring gasholder

Of the three steam stations with an output of less than 50,000 kWh, the best result was 2.42 per cent. and 12.24 lb., compared with 24.9 per cent. and 0.7 lb. obtained by Abertillery in the corresponding oil-engine group.

The increase in output (million kWh) in 1933 was accounted for by advances in the regional areas as follows: S.E. England, 496; Central England, 225; N.W. England and N. Wales, 161; Mid-East England, 146; S.W. England and S. Wales, 116; Central Scotland, 94; N.E. England, 26; E. England, 25; N. Scotland, 22; S. Scotland, 0.23; total 1,311.

The greatest percentage advance was experienced in E. England (27.8), followed by Central England (12.7), S.W. England and S. Wales (12.6), and Mid-East England (10.2), South-East England came fourth with 10.1. No area retrogressed, though S. Scotland increased by only 1.62 and N.E. England by 2.73 per cent.

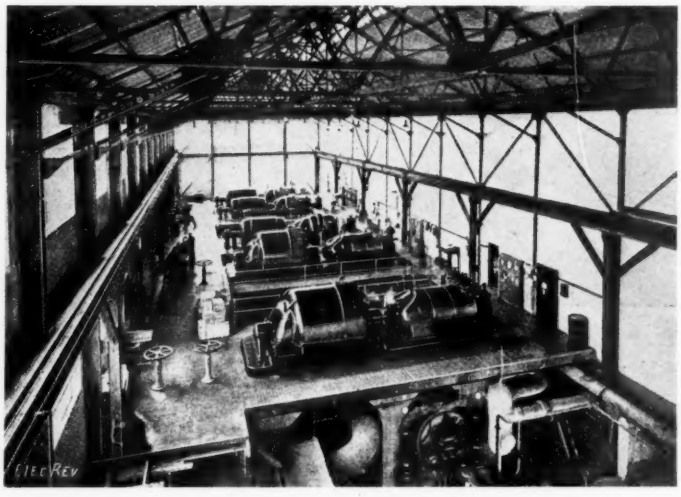
Power Supply at Pretoria Steel Works

THE steel works now completed at Pretoria West by the S. A. Iron and Steel Industrial Corporation, Ltd., are highly electrified, and entirely new methods have been adopted for economising in the use of electricity.

Two Brown-Boveri steam-driven blowers form the core of the plant, since the blast furnace must be supplied at all times with air. The three Yarrow boilers are equipped for burning in the same casing blast furnace gas (about 330,000 cu. ft. per hr.), coke breeze (about 5,100 lb. per hr.) from the coking plant, or small coal, a moderate amount of which is normally also burnt on the grates. In emergencies the maximum amount of steam required by a blower can be raised by burning solid fuel alone on the grate of one boiler.

Steam conditions are 310 lb. per sq. in. gauge and 720 deg. F. Steam not required for running the blower is divided between three Siemens turbo-generators and two Ruth steam accumulators. The accumulators are designed for a maximum pressure of 250 lb. per sq. in. gauge, and are fed through a reducing valve.

The generators at the works power station will take simultaneously live steam at 300-lb. pressure and stored steam at any pressure in the range of 250 to 85 lb. per sq. in. Stored steam will be drawn automatically, as required, from the two steam accumulators, which are, we believe, the first to be installed in the southern hemisphere. Each generator is capable of dealing with a peak load of 5,000 kW at a power factor of 0.75 lagging.



The turbine room of the Pretoria steel works of the S.A. Iron and Steel Industrial Corporation, Ltd.

For handling solid fuel into the boiler house an inclined bucket conveyor has been installed, consisting of continuously spaced buckets carried on a balata belt running at a moderate speed. The fuel, after elevation to bunker level, is received by a horizontal belt conveyor provided with a travelling tripper. Ashes are handled from below the boilers by a slow-speed drag-link conveyor operating under water, and will ultimately be discharged into an elevated hopper spanning a railway track.

The base-load portion of the power requirements is purchased from the city of Pretoria, and a special feature of the works power station is the automatic load and power-factor control gear. The former ensures that all peaks will be met by the works power station; the latter causes the works generators to furnish at all times the major portion of the reactive kVA of the load, so as to keep the power factor of the purchased supply as near as practicable to unity.

It is estimated that the boilers at the dry-quenching (coking section) will furnish normally all the steam required by the by-product plant and 5,000 lb. per hr. besides. This surplus steam, at a pressure of 200 lb. per sq. in. gauge and a temperature of 438 deg. F., is carried through a 5-in. main 1,250 ft. long to the power station, where it will furnish primarily motive power for a steam-driven feed pump. The excess is to be used in a turbine-driven induction generator furnishing about 25 per cent. of the total electric power required by auxiliaries in the power station.

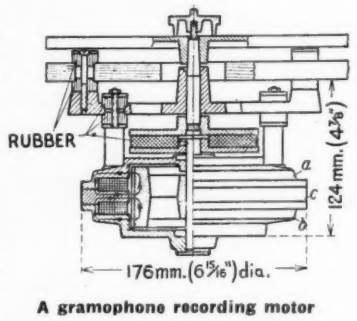
The exhaust from the feed-pump turbine and the small turbo-generator is used for heating the boiler feed water, and the drains from the feed heaters more than cover the make-up required for the station. The surplus hot water is used for the baths, &c., in the power station and adjacent buildings. The 310-lb. steam main is connected to the 200-lb. steam main through an automatic reducing valve and a de-superheater. Should steam commence to fail at the dry quenching boilers, the power station would automatically take over the supply to the by-product plant, the flow through the interconnector (200-lb.) main being reversed in such circumstances.

Electrical metering provides for graphically recording the power generated at the works station, the power purchased from Pretoria, and the total power requirements of the works. All transformers are of the outdoor type. Condenser cooling water is pumped to a cooling tower and recirculated continuously. At all points care has been taken to enable extensions to be made simply and economically when a second blast furnace is installed.

The design and layout of the power plant has been in the hands of Mr. A. M. Jacobs, Commissioner (Engineering), Electricity Supply Commission.

A Synchronous Motor for Gramophone Recording

THE accompanying illustration, from *Elektrotechnische Zeitschrift*, shows the essential features of a single-phase synchronous motor developed by Sander & Janzen, Berlin, to meet the torque requirements of gramophone recording by cutting on hard plates of gelatine or metal. Constant speed is maintained, notwithstanding the decrease in torque required as the needle approaches the centre; and no governor is needed. The stator consists of two end shields *a*, *b* and a ring *c*, with two ring coils of enamelled wire. The rotor is a single-piece casting pressed on a steel shaft.



A gramophone recording motor

Both stator and rotor are of grey cast iron, this being preferable to steel under the conditions obtaining. The motor has seventy-seven poles and slots, corresponding to a speed of 78 r.p.m. at a supply frequency of 50 cycles per sec.; and it is also built for 33⅓ r.p.m., as used in recording speeches. There is the same number of slots in stator and rotor, and the length of air gap is 0.1 mm.

The machine is started by spinning the record-table, and pulls immediately into synchronism. The stator and rotor then oscillate at the frequency of supply, the stator being supported by rubber sleeves and the rotor driving through a rubber coupling. Besides being essential to the operation of the motor itself, the rubber supports ensure silent running and prevent the transmission of oscillations to the record. The bearings of a motor of this type showed no perceptible wear after 22,000 hours' running without attention.

The two windings, connected in series or parallel to suit the supply voltage, carry current in opposite directions, thus establishing two magnetic circuits as shown. This arrangement results in a cancellation of secondary currents, reducing the eddy-current loss to a minimum and improving the phase relations to such an extent that the motor is 28 per cent. lighter than a single-winding machine of equal output.

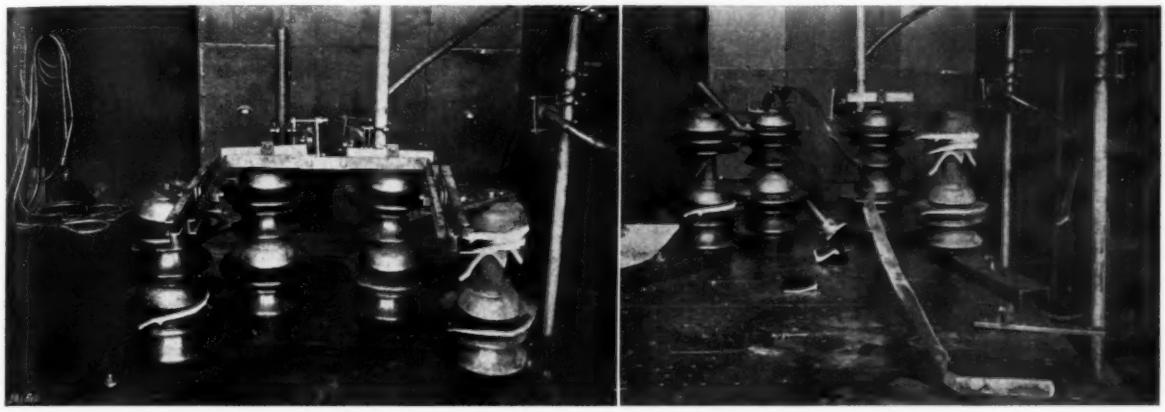
The following data are from tests on a motor rated at 110/220 V, 0.56/0.28 A, 50 cycles, 78 r.p.m.—consumption 33.5 W at 0.54 p.f.; torque 6.6 kg. cm. (5.7 lb. in.) at 78 r.p.m.; output 5.28 W; efficiency 15.8 per cent.; I^2R loss 17.9 per cent.; friction 4.5 per cent.; iron and eddy-current loss 61.8 per cent. The torque developed is about 60 per cent. greater than the maximum required to cut a 12-in. gelatine record; and the relatively high efficiency of 15.8 per cent., compared with 7 per cent. for a single-winding motor, is mainly attributable to the suppression of the secondary currents in the iron. The new motors are being developed also for other applications.

Mining Engineers at Newcastle

The trend of development in colliery electrical equipment

VISITS to the exhibition of electrical mining equipment at Dunston, to the Dunston 50-cycle power station of the North-Eastern Electric Supply Co., Ltd., and to the recently extended short-circuit testing station at Hebburn of Messrs. A. Reyrolle & Co., Ltd., were the most important events of the annual conference of the Association of Mining Electrical Engineers held at Newcastle last week.

At the exhibition it was evident that the most important developments in mining equipment (modern machine mining equipment is definitely electrical equipment) are towards mains lighting at and nearer the coal face, and in the growing use of squat equipment—sub-stations, transformers, gate-end gear, &c.—with the object of bringing the apparatus nearer and nearer the face and where head room is very small. Narrow coal seams are essentially a case for machine mining, and future coal winning in this country will be, it appears, from smaller and smaller seams.



A piece of copper strip (2 in. x ⅜ in.) rigidly held by steel channels before and after testing at 130,000 A at 6,350 V (Reyrolle)

We were particularly interested in the new Reyrolle face lighting system. Lighting units built on lengths of trailing cable with specified spacing each have three lamps balanced over the three phases and neutral of the four-core cable, the lamps being supplied at 25 V from a control unit equipped with a 1½-kVA, 440/44-V (three-phase) transformer. Each phase is separately controlled, so that with an earth on one phase two lamps will remain alight. Each fitting has a prismatic diffuser, under which, over the lamp, is a gauze unit which gives protection in the event of lamp breakage. By unscrewing the head any lamp can be isolated electrically, but only by a special spanner can the fitting be removed from the unit. Sectionalising facilitates advancing with the seam. The control units each have an isolating switch and two plug outlets, and they are suitable also for supplying such face equipment as shot-hole drills. All the internal parts—switch, protection coils, &c.—are built up on a frame which slides in and out as a whole, the frame and the shell having brushing contacts.

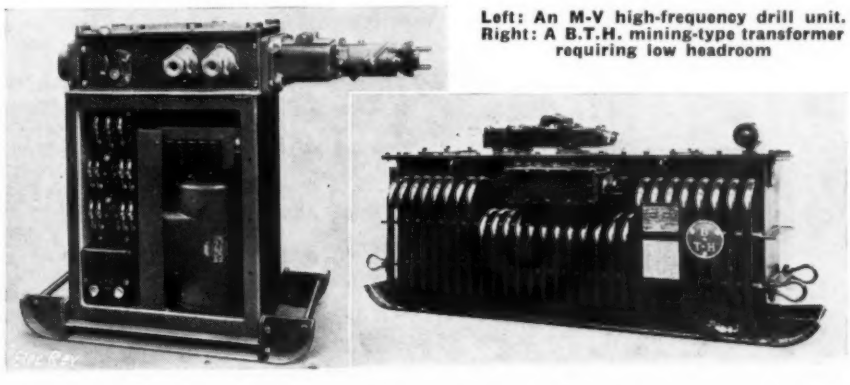
Messrs. Heyes & Co., Ltd., showed us a lighting supply unit fitted with a 75-VA, 110/12-V transformer. It is only about a foot square and eight inches deep, and it takes the form of a flame-proof junction box with plug and socket outlets on the sides. Each plug must receive a part turn before it can be withdrawn, and this motion moves a knife switch inside the box to "off." Concentric cable is employed and the outer (armouring) is earthed to the box. A new range of fittings goes with this unit; we also saw a new flameproof prismatic fitting for up to 250 V, with a separate connection chamber.

Face-lighting fittings produced by Messrs. Siemens-Schuckert (Great Britain), Ltd., have in the head a small cartridge which automatically and immediately exudes CO_2 in the event of glass breakage. A small switch also opens automatically. On the stand of the Wolf Safety Lamp Co., Ltd., we saw a new combination miner's lamp—electric (battery) for travelling and "Airturbo" when used at the face.

For an odd light or so at or near a transformer or switch station we saw among the Metropolitan-Vickers appliances a small 300-W flameproof transformer bolted on between the trifurcating box and the l.p. switch. This company's exhibit was really good, for, by collaboration with makers of mining machinery, working units represented all the operations pertaining to machine mining. The company advocates a complete set for coal-face working, consisting of drills and cutters, two-face conveyors, which may be up to 100 yards long, and a mother-gate conveyor, which may be up to 1,000 yards long. Although in the aggregate there may be 170 or more h.p. in a set, such is the diversity factor that a 60-kW transformer will serve the whole adequately. A transformer unit of this size shown was only about 3 ft. high.

A British Thomson-Houston transformer unit only 2 ft. 8 in. high will go practically anywhere. It is of 100 kVA, one of several ratings for each of which there is a choice of several heights. A portable sub-station seen on the stand of the General Electric Co., Ltd., has a 75-kVA, 3.3-kV to 440-V, three-phase transformer, h.p. and l.p. switchgear and plug-in cable boxes. Its wheel gauge is that of the tub rails, and its overall dimensions are 3 ft. 7 in. high, 5 ft. 8 in. long, and 2 ft. 8¼ in. wide.

On the stand of Messrs. Switchgear & Cowans, Ltd., we were told that there is a general tendency to revert to air-break switchgear. We were impressed by the compactness and accessibility of this company's remote-controlled gate-end switch from which the circuit-breaker proper and the trailing cable are completely removed from the supply source for normal isolation. The Electrical Apparatus Co., Ltd., which is advocating air-break gear, also spoke strongly on this point.



Left: An M-V high-frequency drill unit. Right: A B.T.H. mining-type transformer requiring low headroom

The Mines Department tests are much less stringent than for oil equipment, maintenance is easier, there is greater accessibility, and explosion risk is less.

A notable feature of a gate-end switch shown by Messrs. Laurence, Scott & Electromotors, Ltd., is the bus-bar running right through the separated isolator and main chambers, with the isolator so arranged that the unit can be disconnected independently of the line. This has a fabricated case, by the way, and we soon discovered that welding is used as extensively for mining gear as for other equipment.

One of the best examples of space saving that we saw was

a combined stator and rotor starter shown by Messrs. Erskine Heap & Co., Ltd. It takes about half the floor space of the two-unit equipment. On an air-break star-delta starter seen on this stand, it is necessary merely to remove two screws at the side to pull the drum right out for easy replacement.

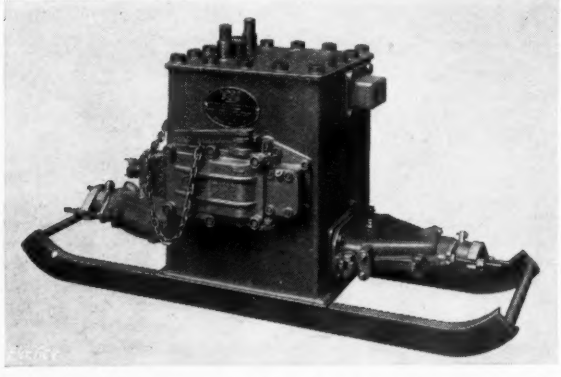
Coal-face lighting in a Midland mine (Siemens-Schuckert)

This unit has wound solenoid overloads—not thermal. The steel reinforcement of the switch contacts by this company is a good scheme.

The most interesting thing we heard about mine pumping was at the stand of Messrs. Mather & Platt, Ltd. In a colliery two waters, say at different levels, which give no trouble when pumped separately, may result in a very corrodible mixture when combined. So it is important that good and bad mixers should be found beforehand, for apart from actual pump trouble the question of single or separate pumping has an important bearing on the power required. The fact that the company can now cater for 10,000 gal. per hr. deliveries against 3,500-ft. heads indicates what a great advance has been made with turbine pumps.

The Harland Engineering Co., Ltd., is justly proud of its new "Spiroglide" self-priming pumping outfit. Cutting out the primer completely from the drive reduces the power by nearly a half. By a piston on the delivery side which operates on release of pressure a friction clutch puts the primer in circuit at "no water"—and *vice versa*. We saw a small B.T.-H. pumping unit for dewatering right up to the coal face; this will deliver 13 gal. per minute against a 60-ft. head. Its ¾-h.p. motor is believed to be the smallest flameproof motor made.

Mr. G. E. Mason, of Lancashire Dynamo & Crypto, Ltd., thinks that the most important mining motor development of the last decade is the externally cooled unit which will enable the totally enclosed motor to be used for work never dreamt of before, simply on price. A 15-h.p. "Fankuld" motor subjected continuously to water pouring on it from above was certainly the most spectacular



A 5-kVA G.E.C. flameproof unit for lighting underground roads

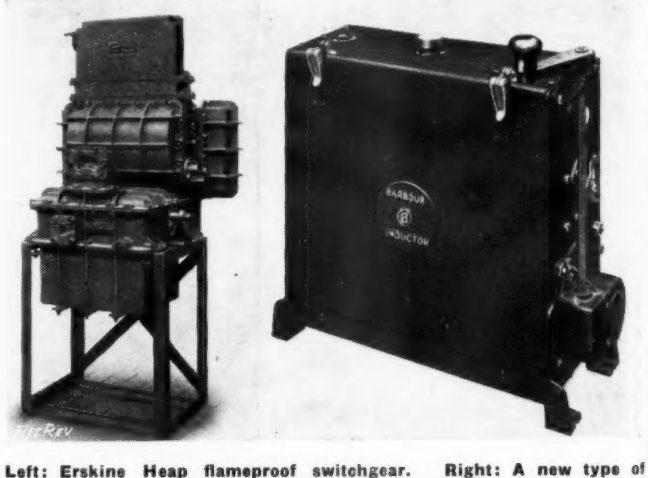
exhibit on his stand. The motor proper is totally enclosed, and a practically enclosed fan blows air along the external ribs. We were given the following prices for 10-h.p., 1,000-r.p.m. protected, "Fankuld" and totally enclosed motors, respectively: £15 10s., £22 10s., and £33 10s.

Messrs. Crompton Parkinson, Ltd., told us that most of the troubles which they encountered were due to fans, and often the protected-type motors scored on this point. The "Klosd" motor, however, has a double case, the inner one completely enclosing the windings. A current of cold air is forced between the two cases by a fan on the motor shaft. The air passage is easily accessible.

The English Electric Co., Ltd., states that drivers experienced in steam winders cannot be got out of the habit of inching the controller handle at the point of "close," resulting in "flapping" of the stator contactor of the electric controller. On its new liquid reversing controller, therefore, the company has arranged a pair of auxiliary contacts which keep the master contactor coil supplied when the contactor is near the closing position. In this controller there is an arrangement by which the acceleration is controlled throughout the complete stroke of the moving electrodes. When the driver's lever is moved from "off," drum contacts are engaged and a magnetic-clutch circuit made, causing a continuously running motor to drive the main spindle of the controller and lower the electrodes. When the main spindle movement corresponds with that of the driver's lever the contacts separate and the clutch circuit is again opened. The electrodes therefore remain in this position and the winder motor runs at a corresponding speed.

We saw several shot-firing drills, appliances with a normal loading of about 1 h.p. which have to withstand peaks of 5 or 6 h.p. They run at about 9,000 r.p.m. and for the 150 cycles necessary for this speed the Metropolitan-Vickers Co. displayed an excellent example of a gate-end unit housing a rotary frequency changer.

Mr. Ericson, of the Automatic Electric Co., Ltd., waxed enthusiastic over the improved "A.T.M." shaft signalling system. Post Office type automatic switches and relays are used and



Left: Erskine Heap flameproof switchgear. Right: A new type of controller (Electrical Apparatus Co.)

the relay bank has been reduced from seventeen to five units. There is sensitive signal cancellation, and provision for reproducing the last signal after cancellation. What impressed us most, however, was the very wide variation permitted in the speed of signalling.

There is some remarkably tough trailing cable insulation on the market nowadays, and Derby Cables, Ltd., W. T. Henley's Telegraph Works Co., Ltd., and others, put up "try its strength" ideas. Henley's showed a vulcanising bath with a practically odourless compound. They claim that the bath arrangement is the best method of heat application.

Callender's Cable & Construction Co., Ltd., have a vulcanising equipment by which a heavy current is passed through a tinned-copper tape "element" wound over the repair. The temperature is measured by a thermocouple and a millivoltmeter. A trailing-cable tester shown by Callender's is a good scheme. A spiral cage and the cable conductor are connected to the poles of an induction coil. The cable is drawn through the spiral, and, of course, sparking indicates a fault when the cage is at that position.

The whole of the control is by moving brushes, without reactances or resistances, in an 8-kW Siemens-Schuckert welding set. It measures about 3 ft. long and 2 ft. high, excluding the wheels and handle.

Dunston Power Station

We described the Dunston 50-cycle station in our issue of February 10th, 1933. The station has been installed to afford a 50-cycle supply in the company's 5,620-sq. mile area, and it is being loaded progressively as the work of frequency change-over proceeds. On the south bank of the Tyne, the area of

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Direct Mail Advertising

It is unfortunate that Mr. W. Greenhough Langshaw, Grad. I.E.E., should rush into print in your issue of June 29th and display his lack of knowledge and understanding of electricity undertakings in general, and advertising in particular. However, to deal with Mr. Langshaw's main points.

He says that "Direct mail advertising is actually not even advertising." Briefly, an advertising scheme is judged by the results obtained. Mr. Alex. R. Carruthers in a recent paper entitled "How to Use Sales Letters" tells of one letter that sold £3,180 worth of goods, and another that added £13,000 to the sales. Is this sufficient proof of the efficacy of direct mail advertising, or need I mention that concerns as wide apart as Austin Reed, Ltd., and the North Met. Electric Power Supply Co., employ the direct mail system and find it a profitable means of advertising?

Mr. Langshaw asks: "Why concentrate on the consumer?" He is very vague on this point. Does he mean the consumer who uses electricity for lighting only? If so, he is again "in the dark." It is the object of all electricity undertakings to develop their domestic load to the fullest extent and direct mail advertising proves an ideal medium.

As to the use of the local Press for an "individual campaign," any Press campaign must be carried out for at least six months in order to achieve success. The approximate cost of weekly insertions for six months would be £80. Experience shows it far better to make fortnightly insertions and devote the other half of the money to direct mail advertising.

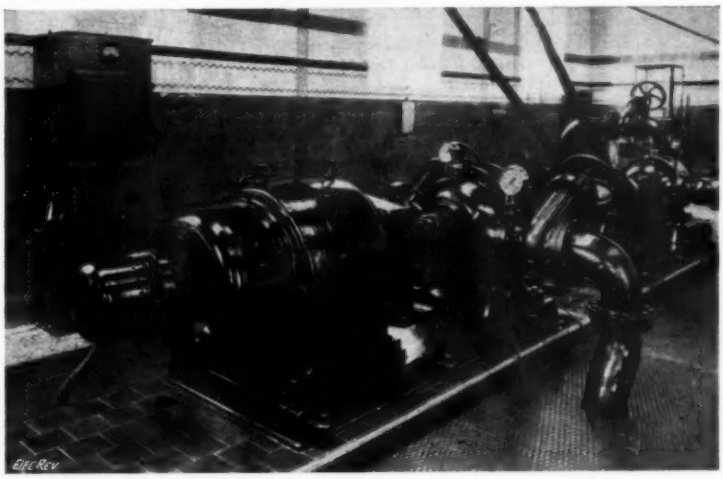
Naturally, poster illumination is not necessary during the summer months, but its employment from October to April increases the effective life of the poster from 50 to 100 per cent. Again, with illuminated posters we are "plus a little something the others haven't got." Mr. Langshaw must agree that if it is not wise to illuminate posters at night, due to women shopping during the day, then surely the thousands of shopkeepers in Great Britain who indulge in shop window lighting after hours are entirely misguided, and are in effect wasting their hard-earned money.

Mr. Langshaw's remarks regarding the self-satisfied attitude of most electricity undertakings are untrue, unfair and unfounded. Week after week one reads of the enterprise of various undertakings in the ELECTRICAL REVIEW. These are forging ahead, and their actual practical experience shows Mr. Langshaw's last contention to be incorrect.

Bury, *July 9th.* WILLIAM F. JARVIS.

Practice and Theory

I am thirty-eight years of age and have had over twenty-two years' practical experience in telephony and electrical engineering. There are, to my knowledge, men totally inexperienced in this work who have been placed by influence on the staff and have become telephone installers or testers, the kind of job which I am unable to obtain, although during my long period at the work I have accumulated the necessary knowledge for such a position.



A 150-h.p. power factor correction motor driving a centrifugal water pump (See page 42)

I have attended classes at the Polytechnic in order to obtain the City and Guilds certificate, but as I have to go right through the course it is going to be four or five years before I shall be able to sit for the necessary examination. Can you or any of your readers tell me of any firms who would be willing to take me as a student or by paying a premium as such allow me to take up the theoretical side?

I am quite confident that with my experience I am fully qualified to take up a staff berth, but I am unable to get one on my own initiative. ASPIRANT.

July 7th.

Laundry Iron Flexibles

The flexless iron of the direct plug-in type which Mr. O. C. Waygood suggests certainly has the advantage of eliminating the flex altogether, and thereby the cause of the original complaint; but this type again has the disadvantage, in my opinion, that two irons are required, each being heated and used alternately so as to ensure continuity of work, thereby doubling the initial cost of the equipment. Again, there is a great deal to be said for an unrestricted ironing surface, especially where ironing tables are used and where no wall is available for fixing the switchplug.

The indicating lamp can be omitted altogether if it is con-

Mining Engineers at Newcastle (*continued from previous page*)

the station site is about seventy-five acres, with a river frontage of about a quarter of a mile. There are at present three 50,000-kW turbo-alternators, and the existing buildings will accommodate a fourth set. The ultimate capacity will be 300,000 kW. An illustration of the station appears on page 56.

The Hebburn Testing Station

Messrs. A. Reyrolle & Co., Ltd., staged for the occasion a spectacular test which "went down" rather well, although Mr. Clothier's warning of a "good deal of spluttering" hardly prepared us for the "howitzer report" of the test. A test piece consisting of 2-in. by ¾-in. copper bar was subjected to a peak current of 130,000 A at 6,350 V, or, say, the equivalent of a three-phase short-circuit of about one million kVA. The result showed the effect of the electro-magnetic forces due to the passage of current through copper conductors of the "open" type, and demonstrated the necessity for rigid fixings.

This testing station has now been equipped with a second special 1,500,000-kVA, 22-kV alternator set (Parsons), and with this in commission the station will have, it is claimed, the largest short-circuit kVA output in the world.

At a luncheon given by the North-Eastern Electric Supply Co., Ltd., Mr. R. P. Sloan, C.B.E., chairman and managing director of the company, said that 200 coal mines now depended on his company for their supply (wholly or in part), and from these the supply company took 40 million tons of coal per annum.

Mr. G. Raw, speaking for the Association, referred to the supply company's normal industrial load of 200,000 h.p., stating that of a total of 37,000 motors (1,000,000 h.p.) 17,000 had already been changed over to standard frequency without an interruption.

Speaking at a dinner given by the Durham and Northumberland Coalowners' Associations, Mr. J. H. B. Foster, vice-chairman of the Durham Association, said that compressed air was inefficient, and they would rather use electricity in mines. Safety was essential, and the Association could do much more by throwing individual knowledge into the scales than by waiting for Government regulations. In ten years electrical plant installed in collieries had increased from 1¼ to 2 million h.p.

At the annual dinner of the Association, Sir Wm. Ray (executive chairman, E.D.A.) referred to the great part mining electrical engineers would have to play in the commencing industrial revival of the country.

In our notes on the exhibition last week the inscriptions under two of the illustrations were inadvertently transposed. These illustrations showing gear produced by Messrs. Erskine Heap & Co., Ltd., and the Electrical Apparatus Co., Ltd., are reproduced again on page 50 with their correct titles.

sidered a luxury, but I can assure Mr. Waygood that despite the fact that it is mounted high up it is still effective, for it can be seen from all directions. On the other hand the cord-absorber suggested by Mr. Cronin has to be most carefully selected or trouble will soon be experienced with the insulation. The drum has to be of large diameter for continuous operation processes, the average domestic absorber being entirely unsuitable.

It would be of interest to have details from Mr. Waygood's experience with flexless irons as to cost of maintenance of the iron contacts and plug sockets.

F. A. ELLIS.

Cardiff, *July 9th.*

Combustion Equipment. By Vernon Walker, A.M.I.E.E.

A review of American practice

RECENT reports of the Prime Movers Committee of the former National Electric Light Association show that the underfeed multiple-retort stoker is usual for large stoker-fired boilers in the United States. Special materials for replacements of this class of stoker are higher priced than the standard materials, and often give no appreciable operating advantage. Tuyeres, for instance, have been alumitised by spraying, but the penetration was not deep enough to prevent growth, and the length of service was not increased when used with preheated air of 350 deg. F. Molybdenum cast-iron tuyeres show no marked improvement in burning or erosion resistance qualities, but alloy-tuyere and coal-plate extension noses containing 1.0 per cent. chromium and 0.5 per cent. nickel appear to have better resisting qualities than grey cast iron.

A complete stoker equipped with nickel cast-iron tuyeres was found to be in very good condition after a year's run, no replacements being required during this period. A reduction in the number of pushers, deepening the retorts and raising the tuyeres has resulted in better control of the fuel bed and reduced maintenance, while better stoker performance has also been obtained by giving more attention to the operation of the crusher rolls and maintaining a thin uniform and rapidly moving fire bed.

Admission of Secondary Air

The general method of admitting secondary air over stoker-fired boilers is through a large number of comparatively small jets in the furnace front wall, but with larger stokers this has been found inadequate. The small jets have little power to penetrate any distance into the furnace, and the admission of secondary air through the front wall to some extent defeats its own purpose, especially when the normal flow of the gases is away from the front wall as in the vertical-tube boiler, in which case the secondary air merely accentuates the direct flow of the gases from the stoker to the boiler. Secondary air has been proved necessary to obtain maximum efficiency and smokeless chimneys at large capacities with coal of a high volatile content.

Extensive experiments prove that secondary air passing through a comparatively small number of large nozzles gives the best results, the preferable location of the nozzles being in the bridge wall. The large jets of air, even when employing the same air pressure as in the stoker wind box, are capable of penetrating the furnace atmosphere to a sufficient distance to cause active turbulence. Where the travel of the flame is away from the front wall and directly into the boiler, these large air jets tend to reverse the travel of the flame and force the burning gases into portions of the furnace which are normally void of flames. In practice, at high output very active combustion is maintained, and there is no doubt that if the overhead air had to go through the fuel bed the ash and unburnt gas loss would be increased. Slagging of the boiler tubes has also been decreased by the use of overfire air.

Flue dirt from the boiler passes that collects in the base of the preheater and contains unburnt coal can be reclaimed by an ejector discharging through the furnace rear wall. If the fines from the economiser and air heater are discharged into the ash pit, localised combustion may result in unfavourable pit conditions, large clinkers being formed which are difficult to remove.

The Use of Baffles

Fuel bed conditions have been improved by the installation of baffles or deflectors under the grate in the forced draft chamber. These baffles reduce considerably the blowing of the fuel bed at high ratings and prevent burning of the tuyeres. Zoned air control on stokers has resulted in a reduction of excess air for combustion, increasing the percentage of CO_2. In certain cases the fuel bed has burnt out more rapidly in some sections than others due to the way the air entered the stoker wind boxes. Air stratification in the wind box was counteracted by installing baffles and making dampers discharge from the fans downwards instead of upwards.

No operating disadvantages have manifested themselves with preheated air up to 350 deg. F. In a boiler operated for a month with air preheated to 490 deg. F. a large number of tuyeres were cracked, undoubtedly due to excessive expansion strains, a condition which it is thought could be remedied were the designer contemplating such high air temperatures. Combustion conditions were, however, satisfactory, the formation and disposal of the clinker with this type of stoker being practically the same as with air at 350 deg. F. The high air temperature apparently resulted in a shorter flame and less tendency to emit smoke. The general opinion appears to be that preheated air above 400 deg. F. would cause increased maintenance.

Quenching water is generally supplied to the crusher pit of the retort stoker, which facilitates the grinding of the large hard clinkers and helps to maintain an even ash pit, the water being ejected through lines either in the front or rear wall of the pit. Corrosion may take place at the supporting plates at the bottom of the stoker due to the crusher pit quenching, but is kept at a minimum by frequent cleaning and painting of the steelwork. Continuous quenching is preferable to periodic, as the latter often results in cracked or burned hoppers and clouds of dust on unloading hoppers.

Stoppage of Coal Supply

Failure of the coal supply due to foreign material obstructing the flow allows the fuel bed to set low in the retorts and burns the tuyere side plates and pushers, but without seriously affecting the tuyeres. To prevent foreign material being fed to the stoker grizzly bars are installed ahead of the coal breakers, tramp iron and debris being caught in the breaker, or magnetic pulleys and pickers are used.

Constant packing is necessary to keep down leakage into the furnace from the ventilating ducts of air-cooled furnace walls. Excellent results have been obtained with water walls, and the maintenance has been practically negligible. If the face of a refractory-faced block breaks off, it can be repaired by filling with plastic refractory. In order to improve stoker performance and raise the final steam temperature, a reduction in the heat absorption of bare water walls has been necessary. A thin coating of plastic insulation was found not to be permanent. Monolithic refractory held in place by reinforcement welded to the tubes has also been tried, while trouble with water walls due to insufficient circulation has been overcome by increasing the number of downcomers and risers. Recent experience shows that there is more pronounced fouling and corrosion of air heaters with stoker-fired than with pulverised-fuel boilers.

Banking and Corrosion

The elements of an air heater on a stoker-fired unit after eight years' service were found to be so badly corroded at the gas discharge end that the use of the heater had to be discontinued; the temperature of the preheated air was 210 deg. F. and the gas discharge 400 deg. F. Preheaters of the same type installed on pulverised-fuel boilers showed no corrosion effects over a similar period. Corrosion is apparently accentuated by the effect of cold air entering the preheaters and unequal distribution of the gas flow, and air heaters operating on boilers that are banked for long periods are liable to an increased rapidity of corrosion.

Loss of heating efficiency in tubular heaters is due to the tube banks most intimately in contact with the incoming air being deprived of their full share of outgoing gases, the condition being aggravated by the natural tendency of the gases to travel by the shorter path of the central banks of tubes, thus leaving the outer banks in a sluggish condition and more susceptible to moisture and clogging. Heaters of this type can be effectively cleaned on the gas side by washing thoroughly with a strong stream of water from a hose. The rotary preheater which has both sides of its heat transfer surface exposed to gases can be kept reasonably clean with the aid of soot blowers.

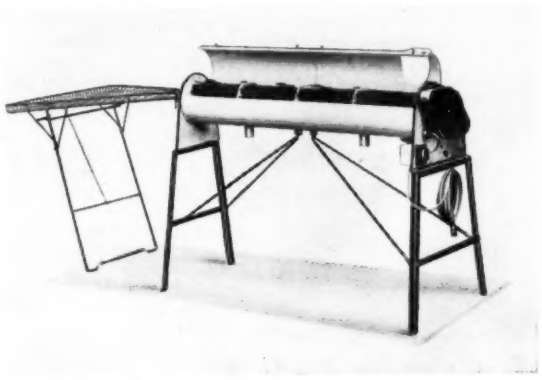
Automatic boiler control is said to give better regulation and to be more accurate than hand control; the stoker speed can be varied in accordance with the change in load, but provision should be made for superimposed manual adjustment as in the case of stoker operation. Control of the quantity and distribution of the fuel on the grate and other special conditions, such as clinker removal from the ash pit, cannot be carried out automatically because of the complications involved.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Egg Cleaning by Electricity

It is claimed that three thousand eggs can be washed and dried in one hour by the "Summit" electric egg cleaner,



The Cope and Cope egg cleaner

introduced by MESSRS. COPE AND COPE, LTD., King's Road, Reading, at the Great Hertfordshire Agricultural Show.

The main body of the machine, as will be seen from the illustration, is circular in shape, and is divided into two sections the first of which contains the water for cleaning and the second forming a guard and bearing for the brushes. Each section is fitted with a quick-operating drain plug. Three long tufted brushes run longitudinally through the whole length of the body, the first half of the brushes being specially designed for washing and the second half for the drying part of the operation.

The eggs are fed into the brushes through a convenient aperture at one end of the machine and travel through the brushes automatically, emerging at the far end on to the wire tray perfectly dry. The brushes of the machine, which form the subject of patents, are of special design and construction.

Heating of the water used for washing is carried out by an immersion heater fitted with an independent switch, while the rotating brushes, driven by a ¼ h.p. low-speed motor, are controlled by a porcelain switch-fuse. Twelve feet of heavily insulated rubber cable are provided with a standard three-pin connecting plug. The drive for the motor is by a ½-in. pitch oil-bath chain, adjustment being made for tension on the motor bed-plate. The measurements are: Overall height, 3 ft. 3 in.; length, 7 ft.; length of brushes, 3 ft. 7 in.; the floor space required is 7 ft. by 2 ft. 6 in. The cost of the machine is £18 10s. for a.c. and £19 10s. for d.c., a really comprehensive instruction card being provided with each machine. The makers advise that a spare set of brushes be kept, so that in the event of a cracked egg being fed into the machine, and being broken, there need be no delay while the brushes are cleaned. It is stressed that efficient and trouble-free working of the machine depends largely upon keeping the brushes perfectly clean.

"Duo-Chrome" Signs

Particulars of the new colour lighting display "Duo-Chrome" sign have been sent to us by HOLOPHANE, LTD., Elverton Street, Vincent Square, S.W.1. The sign works on the optical properties of contrasting colours, involving the application of complementary colours in contrast in such a way that the text matter appears in brilliantly coloured lettering on a background of the complementary colour. All the colours used are produced by coloured light instead of by using pigments or coloured glass. Model "A" is for shop windows, showrooms, cinemas, cafés, &c.; Model "B" is the outdoor double-sided type, "C" is for shop windows and contains at the rear a battery of high intensity shop window reflectors, and type "D" is an outdoor corner sign which can be fitted with automatic changing gear to give a steady flowing change of colour.

A New "Catkin" Valve

A further valve has just been added to the "Osram" 4-volt a.c. mains "Catkin" series. This, the "V.M.P.4" variable-mu screened pentode, has the following characteristics: Filament, 4 V a.c., 1.0 A; anode, 250 V max.; screen, 100 V max.; mutual conductance, 2.5 mA/volt at 200 V anode, 100 V screen and −3 grid; mutual conductance, 0.004 mA/volt approx. at −30 V grid. The valve is fitted with a seven-pin base and is supplied with the usual "Catkin" metal shield, to which an earth connection can be made through the requisite pin in the base. The price of the valve is the same as that of the glass type, viz., 17s. 6d. It is obtainable from the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.

Circuit-breaker Auto-reclosing Mechanism

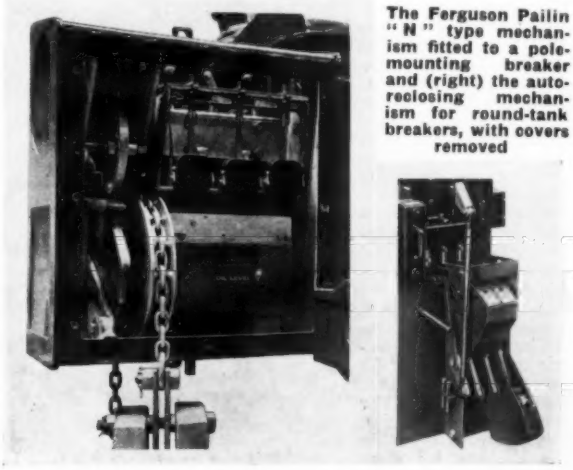
In order to avoid the difficulty and cost of providing, at rural switching points and unattended sub-stations, a source of electrical power for circuit-breaker closing in conjunction with a timed reclosing relay, MESSRS. FERGUSON, PAILIN, LTD., Manchester, have developed two forms of mechanical auto-reclose Type "N" mechanism for application to "P.R." pole-mounting circuit-breakers and to the standard "B.R." oil circuit-breaker for kiosk, cubicle or metal-clad unit mounting. In both designs, energy for reclosing is obtained from falling weights which are restored to the initial position after a given number of reclosures. Recently a type "P.R." auto-reclose breaker satisfactorily tripped and reclosed seven times, the fault being due to a piece of wire thrown over the line which was swung periodically by the wind against some earthed metal-work.

Three new floor standards sold by Messrs. Messenger & Sons, Broad Street, Birmingham, employing electrically welded steel tubes and made by Tube Products, Ltd., Oldbury. Table models are also available

The number of reclosures depends on the length of chain, the weight falling about two feet at each reclosure. The time intervals between reclosures of the "P.R." breaker are adjustable between five and thirty seconds according to requirements. Springs are incorporated in the weight to prevent shock to the mechanism at the end of each fall. Reclosures can be limited to one operation, after which, if the fault persists, the breaker is locked out; but should the breaker remain closed after the first reclosure the remaining possible reclosing operations are then available.

Instead of the series overload trips and time lags normally provided with the "P.R." pole-mounting breaker, current transformers operating double-pole overload and single-pole earth leakage trips, with a definite time lag of 0 to 5 sec., are provided.

The "N" type mechanism which is illustrated below with the cover removed shows the three weights which provide the energy for three successive reclosures at time intervals between eight and thirty-two seconds. After the third reclosure the breaker is locked out and the weights have to be reset.

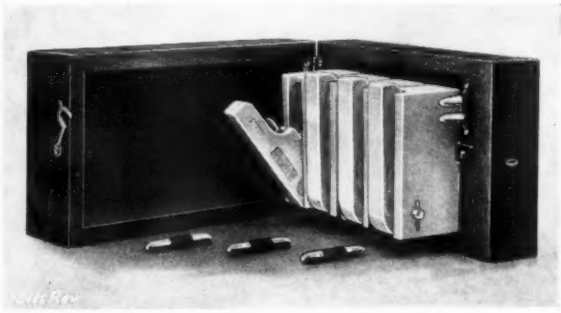


The Ferguson Pailin "N" type mechanism fitted to a pole-mounting breaker and (right) the auto-reclosing mechanism for round-tank breakers, with covers removed

A Cartridge Fuse-board

A new house-wiring fuse-board manufactured by MESSRS. FAULKNER & CO. (MANCHESTER), LTD., 112, Portland Street, Manchester, 1, is designed to prevent incorrect fusing and to secure the safety of the person replacing a fuse.

The "Lymmit" fuse resembles the ordinary porcelain fuse bridge and base unit, but the bridge is hinged at the lower end and so can only be operated like a switch. When the fuse is closed no live metal is accessible and when open the cartridge, which is carried loosely in a channel is disconnected from both contacts. It is merely a finger and thumb operation to remove one fuse and insert another from the three spares carried inside the distribution board. The fusing current is about 100 per cent. greater than the rated current. At present 5- and 15-A sizes are made in teak or metal-clad cases, but a 30-A size in a metal-clad case will shortly be available. A 10-A cartridge can be supplied to fit the 15-A fuse-board.



The Faulkner cartridge fuse-board

The price of the 15-A 230-V model in teak case complete with cartridge fuses is 7s. 4d. for two d.p. ways and 2s. to 3s. for each additional d.p. way. Extra 10- or 15-A cartridge fuses are supplied at 3d. per pair.

Mercury Switch Relays

Three models of mercury switch relays in which the make and break occurs in a sealed tube have been introduced by the DRAYTON REGULATOR CO., LTD., West Drayton, Middlesex, for currents up to 20 A a.c. or d.c. The first is of the vertical type and the 20-A model (the largest size) is supplied at £2 7s. 6d. for making circuit on energising the coil, or at a slightly extra cost for breaking circuit. Breaking takes place between mercury and mercury over the rim of a ceramic tube concentric with the ceramic displacer which prevents the arc burning the quartz glass.

Another model is a single-coil relay, s.p., d.p. or t.p., with single-way tube up to 20 A, or s.p. or d.p. with double-way tube up to 15 A to make or break circuit on energising the coil. The relay is mounted on a bakelite base plate fitted in a metal box. The 20-A single-coil t.p. type costs £4 15s. The third model is a two-coil relay, s.p., d.p. or t.p., operated by two push buttons, the switch remaining in one position until the second coil is energised. It can also be supplied s.p. or d.p. only for operation by two-way automatic control switch. No current passes through the coil except when working, and the actuating switch makes circuit only. The coils take not more than 4 W when holding and 8 W in closing. For pressures above 250 V a.c. and 110 V a.c. a series resistance is included.

The Drayton single-coil t.p. mercury relay removed from the case

Static Condensers

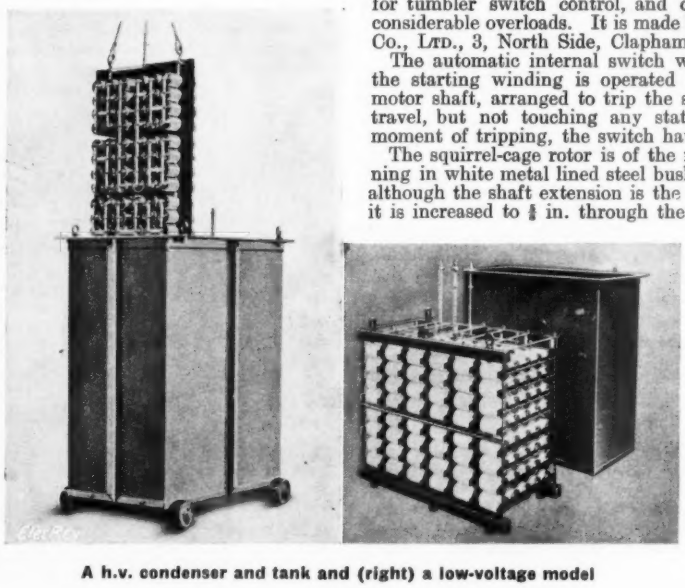
An oil-immersed static condenser for power factor improvement is now manufactured at Charlton by MESSRS. JOHNSON & PHILLIPS, LTD., under licence from Messrs. Haefely (Switzerland). The elements are made by winding on insulating tubes two aluminium-foil electrodes, separated by layers of condenser tissue paper and projecting beyond the paper at each end; this construction is claimed to secure more uniform cooling of the dielectric and to permit the use of larger elements than is usual. For ordinary frequencies, connection is made to the element by stout tinfoil tags at the electrical centre of the element winding, the free end being clamped between brass washers by steel terminal plugs forced into the ends of the insulating tube.

After winding, the elements are dried in air at atmospheric pressure and afterwards under a high vacuum and are then impregnated with de-aerated and de-hydrated oil. Following the impregnating process, which largely decides the life of a condenser, the elements are flash tested and assembled. The elements of l.v. condensers slide on to brass "element slides" by means of slots cut in the terminal plugs, contact being maintained by curved steel springs between the upper surface of the slide and top surface of the plug slot. The slides, which form part of the condenser frame, are supported at the ends by brass tube threaded on steel rods carrying current to the terminal connections on the busbars at the top. The metallic framework is held together and insulated from the tank by impregnated wooden clamps.

Another l.v. condenser, used mainly for smaller units, is the hanging type, in which the plugs at the end of the elements are drilled and threaded on vertical steel rods with the elements suspended horizontally between pairs of steel rods and with brass spacer tubes which carry the current to the busbar at the top. The vertical rods are hung from impregnated wooden clamps suspended from bolts welded to the tank lid. In the l.v. types the individual elements are connected in parallel in each phase for the full working voltage. For h.v. condensers and where elements must be connected in series, the elements are mounted on one or both sides of an insulating board, groups of elements in parallel being connected in series. By this method condensers can be built for 33 kV or higher. The boards are mounted vertically in runners welded to the inside of the tank.

For high-frequency work (up to 2,000 cycles per sec.) connection to the element winding is made by stout pressure contacts on the ends of the element instead of by tinfoil tags. The elements can be wound for any pressure between 200 V and 1,000 V, or even higher, the element kVAR being 0.666 for 440 V and above. After testing the completed condenser is subjected in its own oil tank to vacuum and heat to remove any trace of moisture picked up during erection or present in the tank, together with any trapped air. The lid is then secured so as to make an oil and air-tight joint. There are no soldered, riveted or welded joints for the electrical connections.

The "Neco" type "SP" motor



A h.v. condenser and tank and (right) a low-voltage model

A Small Motor

The new "Neco" type "SP" motor is a single-phase squirrel-cage machine, designed for users who want a simpler and less expensive motor than the repulsion-start induction type, but one suitable for tumbler switch control, and capable of starting against considerable overloads. It is made by the NORMAND ELECTRICAL CO., LTD., 3, North Side, Clapham Common, S.W.4.

The automatic internal switch which is provided to control the starting winding is operated by a collar sliding on the motor shaft, arranged to trip the switch at either limit of its travel, but not touching any stationary part except at the moment of tripping, the switch having no rotating contacts.

The squirrel-cage rotor is of the normal type, the shaft running in white metal lined steel bushes. A special point is that although the shaft extension is the standard diameter of ½ in., it is increased to ⅝ in. through the bearings. The lubrication is by cotton yarn oil pads in large reservoirs, and silent running is ensured by the large sleeve bearings, and the system of dynamically balancing every rotor. These motors are produced in ¼-h.p. and ⅓-h.p. sizes, both in the same frame, the dimensions of which are those now standardised for motors of this type. They are drip-proof enclosed with fan ventilation, and can be wound for any voltage up to 250 V with a full load speed of 1,400 r.p.m.

Temperature Control in Domestic Electric Irons

IMPORTANT information relating to the conditions of temperature in domestic electric irons, with and without thermostatic control, is given in a communication by Dr.-Ing. A. C. Wiese from the electric heating research department of the Technische Hochschule, Hanover. The accompanying curves, from *Elektrotechnische Zeitschrift*, indicate the requirements of the case and show that unless certain basic conditions are fulfilled thermostatic control may be worse than useless. The desirability of some form of automatic control lies in the fact that the sole and top plate of a 450-W iron attain red heat if the current be left "on" while the iron is idle; and a scorching temperature may be reached if the iron is used for some time on dry linen.

Fig. 1, relating to a 450-W iron without regulator, shows the temperatures during 30 min. from switching on, at five points, *viz.*, above and below the heating element, at the centres of gravity of the top plate and sole, and inside the hood. The iron was used on three heavy hand towels, well sprinkled with water. Current supply was maintained throughout the test, and the ironing periods are indicated by the horizontal black bars in the diagram. During the 12-min. heating-up period, the temperature rose steadily in all parts and reached 260 deg. C. (500 deg. F.) in the sole. The temperature rise in the top plate was less rapid, owing to the presence of a sheet of asbestos between it and the heater. Throughout this period, there was a temperature gradient of about 20 deg. C. (36 deg. F.) between the measuring points in positions above and below the heating element and the body of the top plate and sole respectively.

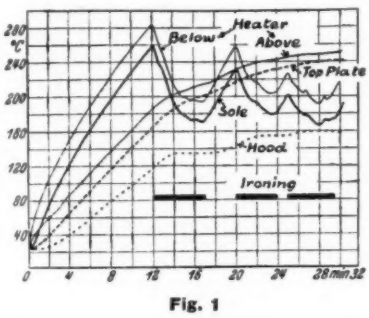


Fig. 1

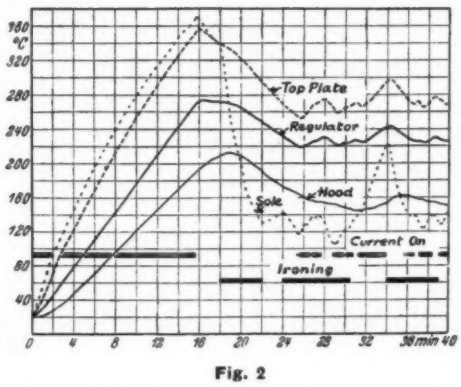


Fig. 2

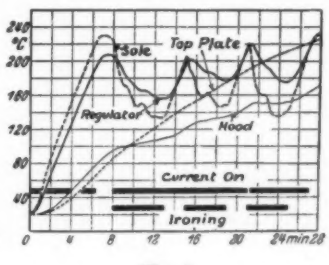


Fig. 3

While ironing was in progress the temperature of the sole fell rapidly to 170 deg. C. (338 deg. F.) or lower, and the temperature on the underside of the heater followed the same course. The temperature of the top plate, however, continued to rise almost unaffected by the ironing. This demonstrates the important fact that heat stored in the top plate is not available for ironing while current is "on," owing to the fact that the heating element between the sole and the top plate is then always at a higher temperature than the latter. The temperature of the hood rose to 160 deg. C. (320 deg. F.), meanwhile remaining practically constant during the actual ironing periods.

Drawbacks of Regulators

A heating element of 600-800 W under the control of a thermal regulator may be used to avoid, on the one hand, the necessity for waiting while the iron reheats and, on the other, the risk of scorching. From the form of the curves in fig. 1 it is evident that the regulating device must be in thermal contact with the sole, this being the working part of the iron and the part liable to the greatest changes in temperature.

In a certain 600-W iron, in which the regulator was actuated by the temperature of the top plate, the sole, top plate and regulator rose practically together to 260 deg. C. (500 deg. F.), the current then being switched off automatically. On commencing to iron, the temperature of the sole fell to 90 deg. C. (194 deg. F.) before the regulator in the top plate reached 180 deg. C. (356 deg. F.) and switched current on again. Thereafter, the sole reached only 180 deg. C. (356 deg. F.) by the time the regulator attained 260 deg. C. (500 deg. F.) and again interrupted the supply.

A worse case is illustrated by fig. 2. In this instance, the regulator was not in good thermal contact with either the sole or the top plate, with the result that by the time it reached 270 deg. C. (518 deg. F.) the sole and top plate were at 360 deg. C. (680 deg. F.), a dull red heat. Current was then switched off automatically and, the temperature of the regulator being determined mainly by that of the top plate as shown by the curves, current was not switched on again until the sole reached 120 deg. C. (248 deg. F.) and, later, even lower temperatures.

Owing to local heating of the contacts, the regulator (a bimetal strip) repeatedly opened the circuit, as shown by the breaks in the shaded areas in fig. 2, while the sole was still too cool for effective ironing. At the end of the second ironing period, fig. 2, the iron had been in circuit for about 60 per cent. of the total time, corresponding to an average input of $0.6 \times 600 = 360$ W. The iron was therefore necessarily less satisfactory than an unregulated 450-W iron as regards maintenance of sole temperature.

The author considers that the regulator contacts should be kept quite distinct from the temperature-sensitive element of the regulator.* The performance of a 600-W iron with a regulator of this type in good thermal contact with the sole is shown by fig. 3. The temperature of the regulator now follows the sole curve, in marked contrast to fig. 2, and the temperature of the top plate follows an independent course. The regulator responds quickly to cooling of the sole and enables full advantage to be taken of the higher rating of the iron, current being "on" throughout the ironing periods in the tests concerned, except for a few seconds when the cut-out temperature of 220 deg. C. (428 deg. F.) was reached. The temperature of the top plate rose slowly, owing to there being a thick sheet of asbestos between it and the heating element.

Ultimately, however, the top plate became hotter than the regulator and sole plate, and switching-off then occurred more frequently and for longer periods than should have been the case. If the top plate and sole were in good thermal contact the regulator would be controlled in all circumstances by the temperature of the sole plate.

*Such an arrangement was illustrated in the ELECTRICAL REVIEW of August 18th, 1933, p. 233.

Rodents in Power Stations. By C. W. Greatorex, F.Z.S.

RECENTLY a house mouse, the *mus musculus* of naturalists, plunged an entire borough into darkness. Both this species, and its larger relative, the brown rat (*mus decumanus*), cause trouble in power stations and sub-stations by running along the bus-bars, or other main connections, and, through the body or tail, making a contact between such bars and the earthed framework.

Stores, appliances, especially rubber, and woodwork of all kinds, may attract the attention of these almost omnivorous pests. In one instance brought to my notice some hundreds of pounds worth of stores were ruined in the course of a year.

An excellent way of preventing the rodents from entering a power station or other building is to cover the outer doors with sheet-iron to a height of about three or four feet. This need not be unsightly.

The best safeguard against rat-and-mouse invasion is the cat. I know of more than one instance in which power stations have been completely freed from pests by the introduction of two or three cats, which seem to have developed an uncanny skill in avoiding contact with live wires.

Potential breeding-places, either indoors or outside, such as empty boxes, old timber, or disused appliances, must not be permitted to accumulate. Dark corners in out-buildings, heaps of refuse in yards, are the situations wherein rats and mice find sanctuary.

Certain traps are useful. Specially recommended is a trap made on the "nipper" principle, which usually kills outright. A rat held fast but not killed not only endures torture but, by its shrill cries, warns all other rats, and thereby reduces the chances of successful trapping on future occasions.

The bait should be varied from time to time. For preference, it should be of a nature *unlike* that which forms the creatures' usual diet.

Some reliable viruses may be used with every prospect of success when spread on suitable bait, such as bread, meat, fish, or grain. They set up intestinal disease, the bacilli of which multiply enormously and pass out with the excreta, contaminating food, and other sources of infection, and thus spreading the disease amongst the rat population.

A very effective destroyer of rats is phosphorus paste; but this must be used with the utmost caution, and ought never to be entrusted to inexperienced hands. Warning notices near the spots where poisoned baits are placed are desirable, and such bait, if not touched by the vermin, ought not to be left indefinitely lest their existence be forgotten. Another poison that must be used with great care is carbonate of barium, in the proportion of one part of carbonate to seven parts of oatmeal, mixed into a paste by the addition of water. A few drops of oil of aniseed increases the attractiveness of this mixture appreciably. Care should be taken lest cats, or other valued animals, gain access to these deadly poisons.

Should the retreats of rats be found, the rodents may be killed by asphyxiation. All entrances, save the main one, should be blocked up. A pad of cotton-wool, soaked in bisulphide of carbon, is then inserted in the main opening which is afterwards sealed. Sulphur dioxide, which is supplied in cylinders, is another sure rat-destroying agent, speedily suffocating the rodents in their burrows. In order to ascertain whether a burrow is occupied, spread a layer of fine sand just outside the entrance overnight. In the morning, occupation will be quite clearly evidenced by the impressions made by the rodents' feet.

The methods recommended for the destruction of rats, may be applied to mice also. Excellent advice upon the subject is contained in Palmer and Westell's work on pests (published by Henry J. Drane).

The new Dunston station of the North-Eastern Electric Supply Co. which was visited by the Association of Mining Electrical Engineers last week

Australian Electrical Imports

THE annual statement of the foreign trade of Australia for 1932-33, with details of the countries of origin of imports, has recently been issued. From it have been extracted the following figures showing the values of the imports of electrical goods, increases or decreases compared with the previous year being added where possible. It will be seen that a slight recovery from the low level of 1931-32 has been made and that the United Kingdom has shared fully in the revival. The imports are recorded in sterling.

The total value of the imports into the Commonwealth of electrical machinery and appliances, including covered cable and wire, in recent years has been:—1928-29, £6,127,000; 1929-30, £6,101,000; 1930-31, £2,842,000; 1931-32, £1,201,000; 1932-33, £1,422,000.

Owing to improvements in the classification, comparison with the previous year is in some cases impossible. For instance, the returns of the imports of dynamo-electric machines, both a.c. and d.c., have been subdivided. Those of the induction type totalled from January 1st to June 30th, 1933, £34,300, with £25,600 from the United Kingdom and £4,900 from the United States; those of the variable speed, commutator type, £1,500 (all from the United Kingdom); while among d.c. machines there was a small import of motors for gearless lifts, value £1,400, all from the United Kingdom. Unclassified d.c. machines totalled £8,900 and unspecified dynamo-electric machines £7,800, mainly from the United Kingdom, but with some competition from Germany and the United States. There is a small item of £3,900 representing the value of convertors imported from the United Kingdom.

The lamp group has also been reclassified to show separately those intended for automobiles, torches and flashlights, and those 20 V and over gasfilled. In all but the last named the competition of Japan is noteworthy. From October 1st, 1932, to June 30th, 1933, the totals were: Automobile, £22,000; torch, flashlight, &c., £8,900; 20 V and over, gasfilled, £20,000; and 20 V and over, other, £29,800.

	1932-33. £	Inc. or dec.
Dry cells—		
Total	1,400	− 600
From United Kingdom	200	− 100
„ United States	900	− 800
Storage batteries for radio sets—		
Total	200	− 1,100
Storage batteries for motor vehicles—		
Total	12,800	+ 5,100
From United Kingdom	7,900	+ 3,400
„ United States	4,500	+ 1,400
Other batteries—		
Total	4,300	+ 3,200
From United Kingdom	1,700	+ 1,200
„ United States	2,500	+ 1,900
Cables and wire (cotton-covered)—		
Total*	10,300	+ 4,300
Cable, telegraph and telephone, paper insulated, lead covered—		
Total*	3,100	+ 1,400
Other telegraph and telephone cable—		
Total*	6,000	+ 3,400
Light and power cable, paper insulated, lead covered—		
Total*	16,000	+ 5,000
Other cable and wire—		
Total	341,000	+ 88,000
From United Kingdom	293,000	+ 88,000
„ United States	17,400	− 9,300
„ Germany	13,500	+ 1,700
Carbon manufactures—		
Total	39,000	+ 2,000
From United Kingdom	14,000	+ 4,400
„ United States	10,000	− 2,000
„ Germany	11,000	+ 7,000
„ France	2,800	− 8,200
Motors under 1 h.p. (separate)—		
Total	27,000	+ 9,000
From United Kingdom	14,000	+ 9,000
„ United States	10,000	− 1,000
Fans, electric—		
Total	3,000	− 300
From United Kingdom	300	− 900
„ Italy	2,400	+ 1,100
„ United States	200	—

	1932-33. £	Inc. or dec.
Induction coils, h.v.—		
Total	15,400	+ 8,900
From United Kingdom	5,900	+ 4,100
„ United States	7,700	+ 3,100
Switches, fuses and lightning arrestors—		
Total	59,000	+ 32,000
From United Kingdom	39,000	+ 29,000
Heating, cooking and domestic appliances—		
Total	18,100	+ 10,600
From United Kingdom	10,400	+ 8,600
„ Canada	2,400	+ 400
„ United States	3,200	+ 1,500
Measuring and recording instruments—		
Total	45,000	+ 18,000
From United Kingdom	19,000	+ 8,000
„ Switzerland	5,300	+ 2,100
„ Germany	7,300	+ 3,100
„ United States	10,900	+ 3,000
Regulating and controlling apparatus—		
Total	34,000	− 7,000
From United Kingdom	16,000	− 6,000
„ Switzerland	1,500	+ 1,500
„ Canada	1,000	+ 500
„ United States	14,000	− 3,000
Static transformers, 66,000 V and under—		
Total	1,500	+ 300
From United Kingdom	1,000	+ 300
Static transformers, over 66,000 V—		
Total	1,100	+ 350
From United Kingdom	600	+ 200
Telegraph instruments and appliances—		
Total	1,800	+ 900
From United Kingdom	1,700	+ 1,200
Telephones—		
Total	23,000	+ 17,200
From United Kingdom	20,500	+ 17,200

	1932-33. £	Inc. or dec.
Telephone switchboards and appliances—		
Total	27,700	+ 9,100
From United Kingdom	24,000	+ 10,700
„ Belgium	1,400	− 600
„ Germany	—	− 700
„ United States	2,000	—
Vacuum tubes, electrical—		
Total	11,600	− 11,400
From United Kingdom	4,800	− 200
„ Holland	2,700	− 4,900
„ United States	4,000	− 6,000
Radio tubes—		
Total	331,000	+ 95,000
From United Kingdom	46,000	+ 13,000
„ Holland	91,000	+ 9,000
„ United States	193,000	+ 74,000
Radio receiving sets, accessories and parts—		
Total	41,000	− 24,000
From United Kingdom	8,400	− 2,300
„ Germany	2,700	− 2,800
„ Holland	600	− 800
„ United States	25,000	− 20,000
Electrical appliances, n.e.i.—		
Total	149,000	+ 23,000
From United Kingdom	69,000	+ 35,000
„ Canada	600	—
„ Germany	25,000	− 16,000
„ United States	46,000	+ 2,000
Electrical ware of earthenware, including insulators—		
Total	9,300	+ 5,400
From United Kingdom	1,400	—
„ France	4,000	+ 3,200
„ Germany	1,800	+ 900
Electrical insulating paper and boards—		
Total	10,900	+ 1,300
From United Kingdom	5,800	+ 2,800
„ United States	1,800	− 500

* All, or nearly all, from United Kingdom.

Parliamentary News (BY OUR SPECIAL REPORTER)

ON July 4th Mr. Liddall introduced the Electricity Supply (Wireless) Bill "to authorise the use of electric lines for the transmission of electric signals; and for other purposes connected therewith." The Bill (Stationery Office, price 1d. net) is mentioned on page 66.

Mains Radio Sanctioned

The Tynemouth Corporation obtained on July 10th the assent of a Select Committee of the House of Commons to a clause empowering it to enter into agreements for the use of its electricity distribution system for broadcast relay purposes.

Mr. Maurice Fitzgerald, counsel for the Corporation, said that the Ministry of Health in its report on the Bill drew attention to the fact that there was no precedent for this power being given. That was true. During the last session Middlesbrough Corporation sought power to establish a broadcasting relay station and to transmit programmes to its electricity consumers. After debate in the House that was rejected. The present proposal, however, was entirely different. The Middlesbrough proposal was that the Corporation itself should establish and operate a broadcast relay station.

All the Tynemouth Corporation asked was to be allowed to enter into agreements with commercial companies who were sending out wireless programmes. There were companies with Dutch capital doing a lot in that way. They ran wires to houses and it was surely much better instead of using that unsightly method to make use of the existing electric wires running underground. It was possible to send the programmes along the electric light wires without affecting the lighting and to give the receiver some choice of programme.

The Chairman asked what the Ministry thought about the proposal. Mr. Sheepshanks, of the Ministry of Health, said they had no views to express. Mr. Fitzgerald said that the Ministry of Transport thought it would be a useful power.

Mr. Sheepshanks said that if Middlesbrough had limited its proposal in this way exception would not have been taken to it. The Committee decided to allow the clause.

Trolley Buses Replacing Tramways

When the London Passenger Transport Board's Bill came before a Select Committee of the House of Lords presided over by the Earl of Wemyss on July 10th, there were only two opponents, the Stepney Borough Council, which objected to the proposal to convert the present conduit trams from Aldgate to Grove Road, Stepney, to overhead working, and the L.C.C., who had petitioned against the exemption of the Board's transport buildings from the operation of the London Building Act.

Lord Ashfield, chairman of the Board, gave general evidence in support of the Bill. Dealing with the proposal to convert about eighty-five miles of tramways to trolley-vehicle working, he said that he had satisfied himself of the success of the trolley-bus system. He did not think there was any doubt that it was a great improvement on the tramway system. He appreciated the reason for people objecting to overhead wires but he could not see any distinction between poles for electric light wires and poles for trolley wires. Additional poles would not be required even if it were decided to abolish the conduit trams on the Embankment and substitute trolley buses.

He thought that eventually a considerable mileage of tramways would disappear from the London streets. So far as his present knowledge went the only way of getting rid of tramway obstruction to other traffic was to use trolley buses.

Mr. J. E. Thomas, tramway manager to the Board, who also gave evidence, said that if the Bill passed it was the intention to make the change to trolley vehicles forthwith.

The Committee decided to allow the Bill to proceed and it was ordered to be reported to the House.

The new Lawn Road Flats, Hampstead (See page 60)

Part of the service kitchen; a bedroom; and a sitting room showing the electric fire unit, which can be moved

In the Courts

IN the Chancery Division on Monday last, before Mr. Justice Crossman, Radiovisor Parent, Ltd., petitioned for sanction to the reduction of its capital from £276,000 to £43,000 by cancelling unissued shares and reducing the value of issued shares, due to a great extent to a loss sustained as the result of litigation.

His Lordship sanctioned the reduction.

Mullard v. Philco

The Mullard Radio Valve Co., Ltd., whose action against the Philco Radio & Television Corporation of Great Britain, Ltd., and others was dismissed by Mr. Justice Farwell on July 3rd (*vide* our last issue, page 16), has decided to appeal against the judgment.

Alleged Patent Infringement

In the Chancery Division on July 10th Mr. Justice Luxmoore had before him an action brought by the British Thomson-Houston Co., Ltd., against the Universal Electric Lamp Co., 82, Great Eastern Street, E.C., on a summons for directions issued by the plaintiffs in the action which they brought against the defendants for the alleged infringement of their letters patent No. 228907 of 1925 for improvements in or relating to frosted glass articles and methods of making them, the invention relating to frosted glass bulbs such as are utilised in electric incandescent lamp and similar electrical devices and to other hollow frosted glass articles in which the glass is thin and subject to breakage.

Mr. Whitehead, K.C., in support of the summons, said that the invention, the subject of the plaintiffs' patent, related to the methods of preparing the frosted surface on the inside of such articles. He said that the pleaded defences to the action were that the patent was invalid for want of subject matter by reason of prior user, prior publication and common general knowledge. By the summons the plaintiffs asked that the defendants should be ordered to give them further details of their particulars of objections as without them the plaintiffs might be prejudiced at the trial of the action.

After hearing Sir Stafford Cripps for the defendants his Lordship held that plantiffs were entitled to further particulars.

Libel Action Settled

A settlement is announced of the action brought by Mr. John Sims, former electrical engineer to the Grange-over-Sands Urban District Council, and Mr. E. Dakin, for alleged libel. The action arose out of a statement in the Council's annual abstract of accounts which led to Mr. Sims being surcharged for various items in his department's accounts. Subsequently Mr. Sims was dismissed by the Council but in October, 1932, the Ministry of Health held an inquiry as a result of which the whole of the surcharges were quashed. The settlement provides for the payment to Mr. Sims of £200 and costs and the publication of an apology by the defendants.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Cottages in the Strand

The pair of cottages, one of which is electrically equipped, occupying a site at Aldwych, Strand, W.C.2, are to be demolished next month to make room for an extension of Bush House, and they will be closed on August 1st. For over a year the cottages have remained open to the public. They were built for demonstration purposes from the winning design in a competition held by the Building Centre, and it is interesting to note that, as a result of the competition and erection of the cottages, information has been received of well over 2,000 cottages which have been built, or are in contemplation, employing this design.

An Arcade Lighting Installation

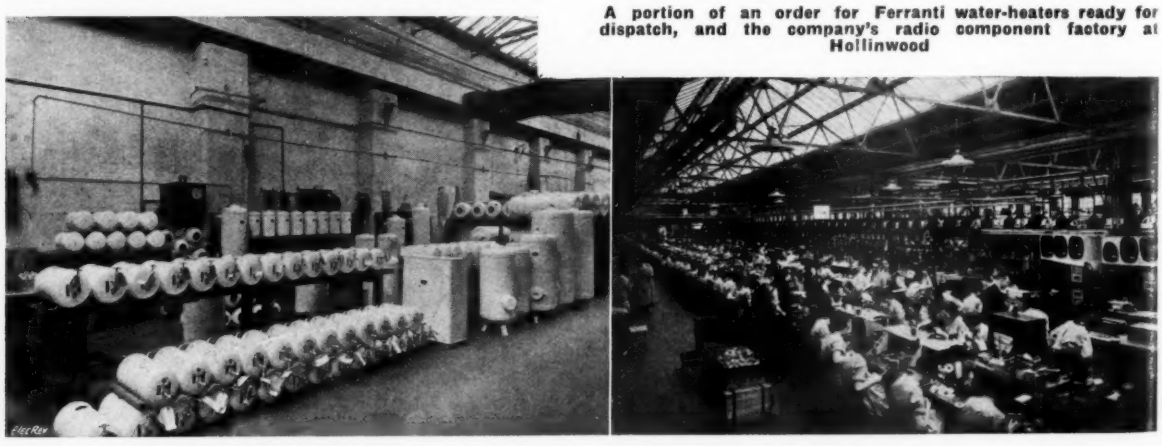
In the accompanying illustration we show the new lighting fittings which have recently been installed by the General Electric Co., Ltd., in the Royal Arcade, Piccadilly, W. These

The new lighting fittings in the Royal Arcade, Piccadilly

lanterns are of special design, and are made of copper with cast egg-and-dart moulding, finished in real bronze colour and glazed with obscured morocco glass. The fittings are 20 in. in diameter, and measure 2 ft. 6 in. overall. They are fitted with a silvered glass mirror in the base for directing the light downwards. Each unit is fitted with one 200-W and three 60-W "Osram" lamps, and they are suspended 15 ft. from the floor level.

Ferranti Activities

The demand for Ferranti electric water-heaters continues to increase, and in the left-hand illustration we show a portion of an order ready for dispatch to a municipal electricity undertaking. The right-hand picture shows the company's radio



A portion of an order for Ferranti water-heaters ready for dispatch, and the company's radio component factory at Hollinwood

component factory at Hollinwood, where all the parts of its receivers are built, as well as the components for home constructors. The company states that its factory has now reached the new high peak of over 6,200 employés.

A Rectifier Brochure

The well illustrated 40-page publication, No. 329/A170 E, issued by Rotax, Ltd., 319, Regent Street, W.1, deals much more fully than is usual with oxide-cathode valve and mercury-vapour rectifiers. The fundamental principles are outlined and design and constructional features explained, while a considerable amount of information is included about performance and such diverse applications as battery charging, for which outputs up to 180 A are now available; telephones and telegraphs; lifts, hoists and cranes; driving d.c. motors off a.c. mains; electro-magnets, magnetic chucks, and electro-medical apparatus; while this form of rectification is particularly favoured for cinema projection. The company claims that nearly five thousand Newton rectifiers are in service.

"Tricity" Fires

In our issue of June 8th, page 840, we announced that the British Electric Transformer Co., Ltd., had disposed of its "Tricity" cooker business, which related to the manufacture and sale of electric cookers and certain other heating and cooking appliances, to Tricity Cookers, Ltd., a new concern. The former company now informs us that this does not in any manner affect the sole selling and manufacturing arrangements which it has had established for some time with Messrs. L. G. Hawkins & Co., Ltd., who have the sole rights in connection with "Sunray Tricity" and "Tricity" electric fires. All orders and inquiries should, therefore, be forwarded direct to Messrs. L. G. Hawkins for finished goods and repair parts.

Municipal Trading in Sydney

The Sydney Municipal Electricity Committee has decided to recommend that the sale of electrical apparatus and the wiring of properties by the municipality be discontinued. The business of selling and leasing electric motors is to be retained, as this has proved to be lucrative. The Lord Mayor, who was asked to attend the meeting, said that the abolition of the sales branch would conflict with the terms of an agreement between the Civic Commissioners and American financial houses for a loan, which was to be applied principally to the extension of the electricity undertakings. Alderman Sir S. Walder said it was implied that American bondholders controlled the activities of the electricity department, and he was advised that the closing of the sales branch would not be a breach of the agreement.

New Municipal Showrooms

Darwen Corporation's new electricity showrooms in Market Street were opened by the Mayor (Councillor J. T. Clark) on July 5th. Councillor Davies, chairman of the Electricity Committee, said that Darwen was one of the smallest suppliers of electricity for domestic purposes in the county. Whereas the yearly average of thirty Lancashire towns was 81 kWh per head, Darwen's average was only 45 kWh. The showroom had been inaugurated to stimulate the domestic load. The Department had found that those electricity authorities which had established showrooms were far outstripping those without them. Darwen had 10,450 houses and 6,220 were connected up. Under the new rateable-value system it was possible to have electricity at the lowest price in the country. Not more than half the houses of Darwen had a hot-water supply, and this was a large field in which the Electricity Department could work. A picture of the new showrooms appears on page 64.

At its last meeting, the Dundee Town Council approved of the establishment of an electricity showroom as part of a scheme for the development of the sale of electricity. The annual running costs were estimated at £1,700. The local branch of the Electrical Contractors' Association which had previously protested against the proposed scheme withdrew its opposition. The Association now expressed itself agreeable to the showroom provided its use was confined solely to the display and demonstration of electrical appliances and to the hire of cookers, washboilers, and self-contained water-heaters.

The Watford Corporation Electricity Committee has approved plans for the erection of new showrooms at an estimated cost of £23,000.

Worthing Town Council is to erect electricity showrooms in Chapel Road at an estimated cost of £17,500, including £7,500 for the site.

A Centralised Service Organisation

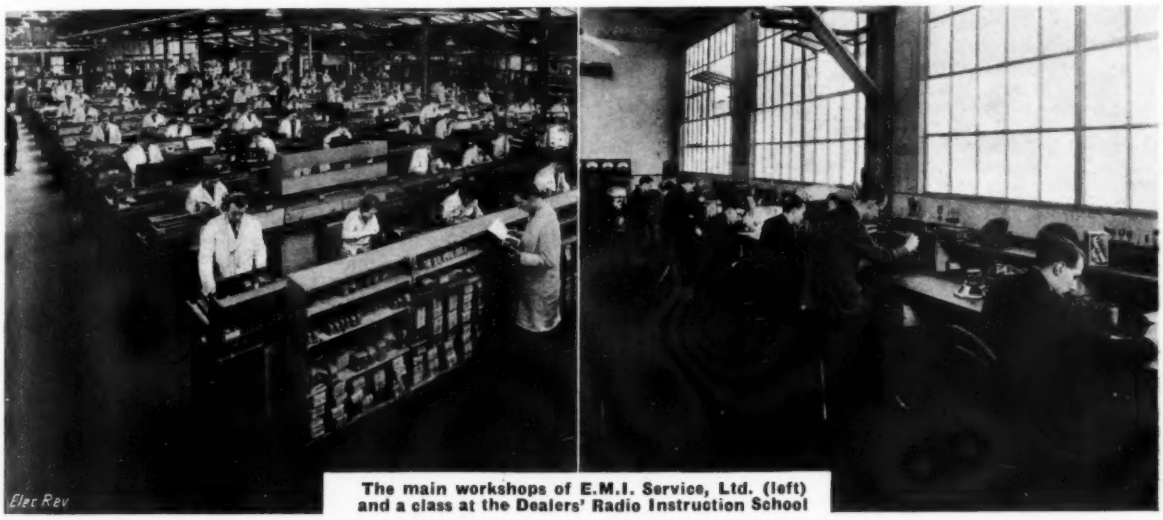
E.M.I. Service, Ltd., which has been organised by Electric and Musical Industries, Ltd., provides a centralisation of the service work of the H.M.V.-Marconiphone-Columbia group of companies.

An extensive establishment at Hayes is fully equipped for repairing and reconditioning all the types of radio, gramophone and household appliances marketed by the group.

The new concern, of which Mr. E. J. Emery is managing director, has been founded on a self-supporting basis, and it is self-contained in order that it should not be affected by the production departments. One advantage of this centralisation is that it permits the study of servicing aspects of any new products from the earliest stages. The number of component parts kept in permanent stock is considerable, yet it is now possible for any spare part for an instrument manufactured during the last five years to be supplied immediately on demand.

A hundred field engineers operate from completely equipped service depôts in London, Glasgow and Dublin. Each carries an official identification warrant bearing his photograph and signature, and a standard charge is made for attendance irrespective of the distance travelled. The field engineers undertake complete installation of equipment and its maintenance, and also investigations. Instruments that need overhauling and repairing, or suspect components, are sent to the Sheraton service factory at Hayes.

Prominent in these activities is the assistance and advice offered to the trade in the form of lucid and comprehensive service manuals and essential information on circuit diagrams, valve data, &c. A Dealer Training School at Hayes (separate sections for radio and refrigeration) provides technical instruction in the practical repair of the companies' products. Allied to this subject of training is the instruction which the E.M.I. organisation is prepared to offer dealers for their guidance in establishing a sound costing and record-keeping system.



The main workshops of E.M.I. Service, Ltd. (left) and a class at the Dealers' Radio Instruction School

The Austrian Wireless Exhibition

The Department of Overseas Trade has been notified that the Austrian Broadcasting Company ("Ravag") is organising with the co-operation of the Vienna Fair Company, a wireless exhibition to show the development of European broadcasting. This exhibition, which will last for about three months, opens in Vienna on October 1st next. Equipment of historical interest as well as the most modern apparatus will be displayed, covering telephony, telegraphy, television, etc. Trade organisations and/or private persons, desiring to exhibit, should apply for particulars to the Management of the Oesterreichische Radio Verkehrs A.G., 4, Johannesgasse, Vienna 1.

Polish Foreign Trade

A report issued by the Department of Overseas Trade reveals that the economic situation in Poland at the close of 1933 was less favourable than at the time of the submission of the last report in February, 1932. The deterioration was noticeable in most directions, but particularly in agriculture on which the prosperity of the country primarily depends. In view of the fact that the United Kingdom has consistently provided a larger favourable Polish trade balance than any other country, it is thought that there should be opportunities for increasing our exports to Poland. The United Kingdom goods for which openings exist are mainly in the categories of raw materials, semi-manufactures, special machinery, instruments and chemicals. Electric motors are normally an important item; latterly, however, imports to Poland have fallen off. The following figures show the value of electrical imports in zlote (£1 was equivalent to 28.935 zlote at January 31st last) in the years 1932 and 1933 respectively:—Electric motors up to 500 kg., 1,689,000 and 909,000; above 500 kg., 1,061,000 and 750,000; other electrical machinery and various parts, 2,128,000 and 1,857,000; electrical apparatus and conductors, 24,800,000 and 19,500,000 (the U.K. share remained at about 2,400,000); telephone apparatus (largely from U.K.), 7,445,000 and 5,757,000; wireless instruments (from Germany and Austria), 821,000 zlote in 1933, representing half the 1932 value; heating, cooking, &c., apparatus have remained at about 250,000 zlote; unspecified electrical material accounted for 1,231,000 zlote, and electric porcelain, 217,000; carbon brushes and electrodes, 914,000 zlote in 1932 and 1,271,000 in 1933. The policy of the Polish Government is to protect local manufactures by high customs duties and to encourage the establishment of undertakings to manufacture articles which are now imported.

The Transport of Large Machinery

Messrs. C. A. Parsons & Co., Ltd., Heaton, Newcastle-on-Tyne, are shipping to Lutterrade, in Holland, a consignment of electrical machinery for the Dutch mine power station at Mauritis. The cargo consists of a stator weighing 40 tons and a rotor weighing 15 tons. They have been loaded on to a wagon and will be shipped to their destination *via* the Harwich-Zeebrugge train ferry without transhipment.

Trade Announcements

Ferro Concrete & Electrical Construction, Ltd., has removed its London sales and registered office to 20, Bucklersbury, E.C. (telephone: City 4586). The Contracts Department has been transferred to the company's works at Pitts Cleave Quarry, Tavistock, Devon.

Mr. Norman Mackay has commenced business as an electrician at Ullapool, Ross-shire.

Price Reductions

Leda Electric, Ltd., informs us that a number of price reductions were put into operation on July 2nd in respect of its refrigerators.

Recent Contracts

A complete scheme of stage lighting and draperies, including a cyclorama, is provided at the new Leyton Baths, part of which is convertible into an entertainment hall. The installation was carried out by Holophane, Ltd.

The Cambridge Instrument Co., Ltd., has recently received an order for the supply of dial thermometers to the British warships H.M.S. *Kingfisher*, H.M.S. *Woolwich*, and H.M. Submarine *Seawolf*.

The Victoria Falls and Transvaal Power Co., Ltd., has placed another contract for generating plant to be installed in the new Klip River station, South Africa, with the Metropolitan-Vickers Electrical Co., Ltd. The contract covers the supply of three turbo-alternator sets each of 33,000-kW capacity, complete with condensing plant. The turbines will be of the two-cylinder impulse type; the low-pressure cylinder in each case being designed for double flow of steam exhausting into a twin condenser of the "Metrovick" central flow surface type. The alternators, which are duplicates of those previously supplied by the same company, are wound for 10,500 V at 0.825 power factor. The plant runs at 3,090 r.p.m. corresponding to a frequency of 51½ cycles per second. Combined main and pilot exciters are provided, and there are two sets of motor driven ventilating fans on each alternator. Three units of similar capacity were supplied to the Victoria Falls and Transvaal Power Co. for its Vereeniging power station some years ago. The whole of the plant under the present contract will be manufactured at the Trafford Park works of the company.

Messrs. Balfour, Beatty & Co. have placed an order with the South Durham Steel & Iron Co., Ltd., to supply, erect and test a further steel pipe line (about 1,000 tons in all) for the extension of the power station at Loch Rannoch, of the Grampian Electricity Supply Co.

British Insulated Cables, Ltd., has received an order for the supply and erection of overhead electrical equipment for the suburban railway lines in the neighbourhood of Warsaw. The value of the order is over £200,000.

A Manchester Company's New Premises

From Monday next the new address of the Northern Steel & Hardware Co., Ltd., will be Northern House, 7, Gartside Street, Manchester, 3. The telephone number will remain

The new premises of the Northern Steel and Hardware Co.

unchanged. The new building, which is shown in the accompanying illustration, is an up-to-date warehouse, and a large showroom has been arranged where all new lines will be exhibited as soon as they are released by the manufacturers. An adequate trade counter has been provided, and arrangements have been made for increased staff to be in attendance.

The Royal Agricultural Show, Ipswich

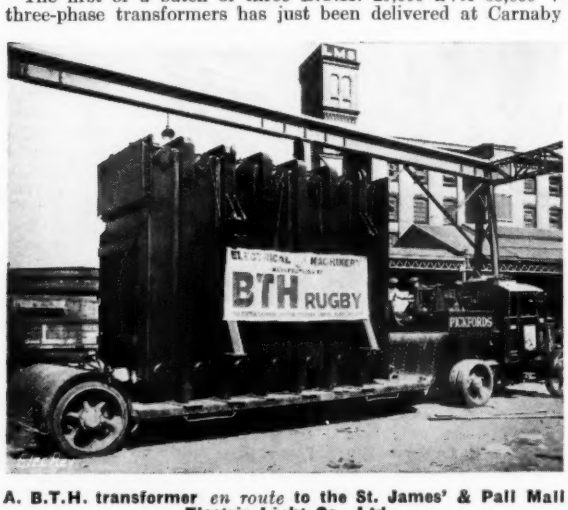
In our issue of June 8th, p. 840, we gave details of the display of the British Electrical Development Association at the Royal Agricultural Show, Ipswich, which was held last week. We now reproduce a photograph showing the attractive arrangement of a section of this display.

Up-to-date London Flats

On Monday last Miss Thelma Cazalet, M.P., opened a block of thirty flats in Lawn Road, Hampstead, under the auspices of Isokon, Ltd. These are well and efficiently equipped with "functional" furniture of a modern character and with a number of central services. The flats are not "all-electric" but in the kitchen of each is an electric cooker ("Revo" or "Creda") and an "Electrolux" refrigerator. The lighting is provided by appropriate fittings of a handsome character supplied by Messrs. Troughton & Young and Messrs. Best & Lloyd, Ltd. Electric fires are supplied if the tenants require them, points being provided for the purpose. The electrical installation work was carried out by Messrs. White, Bays & White. Illustrations appear on page 57.

A Heavy Load in the West End

The first of a batch of three B.T.H. 20,000 kVA 66,000 V three-phase transformers has just been delivered at Carnaby



A. B.T.H. transformer *en route* to the St. James' & Pall Mall Electric Light Co., Ltd.

St. sub-station of the St. James' and Pall Mall Electric Light Co., Ltd. The tank with core and coils weighing about fifty tons was transported by rail from the B.T.H. Rugby works to Camden goods station and thence hauled to site by road. Our illustration shows this load being prepared to leave Camden for Carnaby Street. The three transformers will receive power from the Battersea station of the London Power Co., Ltd., at 66,000 V and transform it down to 22,000 V.

Annual Holidays

The works and offices of the Cressall Manufacturing Co. will be closed from August 6th till August 11th, inclusive. A curtailed staff will be in attendance in the offices to deal with urgent matters.

The works and offices of Higgs Motors, Ltd., will be closed from August 4th to 11th inclusive.

For the third year in succession Messrs. S. Wolf & Co., Ltd., are paying employés who have completed one year's service full wages during the August holiday week.

The Metropolitan-Vickers Electrical Co., Ltd., is closing its works at Trafford Park, Manchester, and at Sheffield, from July 27th to August 7th. There will be a staff in attendance to deal with matter of extreme urgency.

Electrical Equipment Displays

Rowland's Electrical Accessories, Ltd., is arranging a series of special displays of "R.E.A.L." electric fires, industrial reflectors, and factory lighting equipment. The first of these is being held during the week commencing July 16th, at the Grand Hotel, Bristol, and will be followed by a display in London at the offices of the company's London agents and representatives, Messrs. Hogan & Wardrop, Ltd., 25, Old Street, E.C.1, during the following week. Further displays are being arranged in Birmingham, Manchester, Sheffield, and other towns.

Spanish Radio Industry

With the aid of protective duties the manufacture of wireless apparatus has developed on a modest scale in Spain. Loud speakers, condensers and transformers are made of good quality to sell at a fair price, but business is reported to be poor at

The E.D.A. display at the Royal Agricultural Show, Ipswich

present. German imports have suffered, but there is still a moderate amount of successful competition from the United States.

American receiving sets with five valves and loud speaker have a good footing at 125 pesetas (about 70s.) retail, thanks partly to the depreciation of the dollar. So attractive are the prices of "kit" sets from the United States that German importing firms which formerly handled material from their own country are being forced to stock the American article. Efforts are being made to induce the Spanish Government to grant greater protection to the producers of complete sets.

A Price Correction

The prices of the pump and equipment advertised by Messrs. Thomas & Son (Worcester), Ltd., on page xxxvi of the advertisement section of our last issue are £15 10s. and £1 10s., and not as stated.

The Timber Market

Our Timber Trade Correspondent reports that considerable activity has been experienced in the market for building and joinery woods during the past month, imports of which have been heavy. The choice hardwoods generally still continue in small demand and supply, but mahogany in the log and sawn has been imported more freely and is increasing in usage. Also the majority of the other popular Empire timbers are in increasing demand. The American woods (oak particularly) have not been imported so largely during the past month, and this section of the trade is a little unsettled on account of the higher code prices.

German Electrical Industry

It is reported from Berlin that the revival in the inland market which was perceptible in the first quarter of this year continued in the second three months. While no large orders have been received from the local authorities owning supply works and tramways, those booked from the industrial works have been specially large, and even the smaller trades increased their requirements. In the export markets trade is stated to be still very difficult.

An Austrian Amalgamation

It is announced from Vienna that the amalgamation is taking place of the Austrian Telephonfabrik A.G. vorm. J. Berliner and the Ver. Telephon und Telegraphenfabrik A.G. Czeija-Nissl., between which close relations have existed for some time past.

Prices of Materials

Messrs. F. Smith & Co. report, July 11th: No change in the prices of electrolytic copper bars, wire rods and h.c. wire and silicium bronze wire.

Messrs. James & Shakespeare report, July 11th: No change in the price of copper bars (best selected), sheet and rod. Electrolytic copper sheets, £32 10s. to £33, 15s., dec. English pig lead, £12 10s., 5s. dec.

Messrs. Edward Till & Co. report July 11th: India-rubber, Para fine, 5½d., ¼d. inc.

Italian Trade Returns

A recent return shows that Italian imports of foreign electrical machinery and apparatus during the first three months of this year were to the value of £388,035 (assuming 60 lire equals £1), compared with £406,066 in the corresponding three months of 1933. There was also a decrease in the exports of similar material from Italy from £182,850 to £154,100.

A section of the stand of Messrs. Falk, Stadelmann & Co., Ltd., at the recent Levant Fair and Exhibition

For Sale

Ilkley U.D.C. Electricity Department has for sale surplus d.c. plant.

(See our classified advertisements.)

Catalogues Required

Twickenham Electrical Wholesalers, Ltd., 62, York Street, Twickenham, Middlesex, asks for lists and discounts from manufacturers of conduit fittings and accessories, and lighting fittings.

Social Event

On July 7th the employés of Messrs. Page & Miles, Ltd., held their annual outing. Assembling at the company's offices at Brighton, the party, accompanied by the directors and guests, left for Weybridge by coach, the route being *via* Horsham, Abinger Hammer, and Byfleet, arriving at the Ship Hotel, Weybridge, where lunch was served. The return journey was made *via* Cobham, Leatherhead, and Horsham.

New Catalogues and Lists

Sternol, Ltd., Royal London House, Finsbury Square, E.C.2.—A waistcoat pocket booklet on "First Aid for the Car."

British Aluminium Co., Ltd., Adelaide House, E.C.4.—A book containing many photogravure illustrations, on aluminium production, its properties and applications.

Power Specialities, Ltd., Viaduct Works, Wexham Road, Slough.—A catalogue of electric lawn mowers.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlet on tallymeters and tallygraphs.

Ferranti, Ltd., Hollinwood, Lancs.—Leaflets on battery valves—variable-mu screened grid, heptode and small power and driver valves.

Hoffmann Manufacturing Co., Ltd., Chelmsford, Essex.—A copy of the Hoffmann portfolio, showing specimen mountings of ball and roller bearings.

Matthews & Yates, Ltd., Cyclone Works, Swinton, Manchester.—A booklet on viscous air filters.

Victoria Electric Plant Co., Ltd., Spenser Street, Victoria Street, S.W.1.—A list of reconditioned dynamos.

British Insulated Cables, Ltd., Prescot.—Leaflet on B.I. enamelled wire.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.—Particulars of a new range of "Solon" soldering irons.

Cressall Manufacturing Co., Ltd., 31-32, Tower Street, Birmingham, 19.—A leaflet describing sliding resistances.

Edison Swan Electric Co., Ltd., 155, Charing Cross Road, W.C.2.—Particulars of new boiler grillers.

L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, Kingsway, W.C.2.—Leaflets on "Sunray Tricity" fires.

Cambridge Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—A folder dealing with automatic regulators.

Revo Electric Co., Ltd., Tipton, Staffs.—A catalogue of electric fans.

Siemens-Schuckert (Gt. Britain), Ltd., 34, New Bridge Street, E.C.4.—A leaflet describing the "Sirama" electric safety razor and a blade sharpener.

Bankruptcy Proceedings

A. Wolstenholme, 26, Bridge Street, Swinton, near Rotherham, electrical engineer.—This debtor's public examination took place at Sheffield, on July 5th. His liabilities were returned at £410 and he had no assets. He said that he had been interested in a second business with two others, but that venture was unsuccessful. Debtor attributed his failure to insufficient profit from work which he executed, competition, and price-cutting. His examination was closed.

D. S. B. Shannon, electrical engineer, Carlton Chambers, Lichfield Road, Mere Green.—Trustee, Mr. F. E. Bendall, Midland Chambers, Warwick Passage, Corporation Street, Birmingham, released June 18th.

J. G. H. Coomber (Popular Radio Stores), 43, Wakefield Road, Bradford.—Trustee, Mr. J. O. Morris, 71, Manningham Lane, Bradford, Official Receiver, released June 4th.

S. M. Shackleton, wireless engineer, 14, Colliergate, York.—Last day for receiving proofs for dividend July 21st. Trustee, Mr. W. A. Kay, 17, High Ousegate, York, Official Receiver.

W. M. Horsfall, electrical engineer, 7, Redcross Street, Liverpool.—Tenth dividend of 4¾d. in the £, payable July 11th at Government Buildings, Victoria Street, Liverpool.

C. S. Ellis, electrician and wireless dealer, 11, Kay Street, Darwen.—Receiving order made June 28th on debtor's own petition. Public examination August 15th at the County Court House, Blackburn.

A. E. L. Trebilcock, wireless dealer, Holyrood Street, Chard.—Receiving order made June 30th on debtor's own petition.

J. R. Durber (Durber Bros.), Red Lion Square, Newcastle-under-Lyme, and City Electrical Supplies, 183, London Road, Stoke-on-Trent, electrical engineer.—Public examination August 2nd at the Town Hall, Hanley.

G. Tate, electrician, 14, Lascelles Road, Leeds.—Public examination July 24th at the County Court House, Leeds.

W. M. Hudson, electrical contractor, 64, Salisbury Avenue, North Shields.—First meeting July 13th at 81, St. Mary's Place, Newcastle-on-Tyne. Public examination July 25th at the Court House, Newcastle-on-Tyne.

A. L. Roberts, wireless dealer, 58, Alfreton Road, Nottingham.—Public examination September 6th at the County Court House, Nottingham.

W. J. R. Ashley (Southern Wireless Services), wireless and electrical engineer, 151, London Road, North End, Portsmouth, and at Southsea.—Trustee, Mr. C. J. Pyke, 87, High Street, Portsmouth, Official Receiver, released June 1st.

Company Liquidations

Britannia Electric Lamp Works, Ltd.—Mr. J. Matson, 14, Sunbeam Road, Park Royal, N.W., has been appointed liquidator in place of Mr. H. Austin, who has resigned that office. As recorded in our June 29th issue (p. 950), this company is winding up voluntarily for the purpose of selling the undertaking to a new company—Britannia Electric Lamp Works (1934), Ltd.

Bourton-on-the-Water Electric Light & Power Co., Ltd.—Winding up voluntarily. Liquidator, Mr. C. V. Wilkins, Bourton-on-the-Water.

Preston Radio & Electrical Supply Co., Ltd.—Meeting, August 10th, at 18, Winckley Square, Preston, to receive an account of the winding-up by the liquidator, Mr. C. W. Callow.

Private Arrangements

J. T. E. Jones and **C. Rutter,** trading as the Neath Electrical Co., 136, Windsor Road, Neath, electricians.—The creditors were called together recently at Neath, when a statement of affairs was submitted which showed liabilities of £1,774. In addition, the bank were fully secured creditors for £342. The net assets were £286, leaving a deficiency of £1,488. It was reported that the business was established in 1923 by the debtor and two others. One partner retired in 1925 and another died in the following year. Since that date the business had been carried on by the debtor, Jones, and Mrs. C. Rutter. Apparently, however, the latter had not taken any active part in the business. At one time there was a branch business at Port Talbot, but that was closed down a little time ago when the stock and fixtures were realised. Recently creditors had been pressing. A resolution was passed confirming a deed of assignment already executed to Mr. W. Wood, of 12, Green Street, Neath, with a committee.

M. Alcock & Son, 47, Lichfield Street, Hanley, radio dealers.—At a recent meeting of creditors a statement of affairs was submitted which showed ranking liabilities of £1,471 and net assets of £351, leaving a deficiency of £1,120. It was decided that the matter should be dealt with under a deed of assignment with Mr. R. E. Clarke, of Messrs. Bourner Bullock & Co., C.A., as trustee, whilst a committee was also appointed.

Dissolution of Partnership

McMurrell, radio manufacturers, 26, Buckingham Gate, S.W.—Messrs. G. McKenzie and E. E. M. Smith have dissolved partnership. Mr. McKenzie will attend to debts.

Electricity Supply

Lighting, Domestic, Power

Aboyne.—ELECTRICITY WANTED.—The residents of Aboyne, Deeside, are desirous of securing electricity for the village. At a meeting of the Special Districts Committee of the Aberdeen County Council it was agreed to recommend that steps should be taken to light the burgh with electricity from the Grampian Scheme. It was agreed to obtain an estimate of the cost of providing standards and the other necessary equipment.

Alsace.—WATER HEATING AND COOKING PROGRESS.—At the recent annual meeting of the Société d'Electricité de Strasbourg reference was made to the rapid progress in the adoption of electric water heating and cooking stoves in the Strasbourg district of Alsace. During the past year the number of electric water heaters in use increased from 2,988 to 3,433, and in total capacity from 4,600 to 5,345 kW. As regards electric cooking stoves, ovens and hot plates, a total of 996 appliances were sold or hired out during 1933, bringing the aggregate load of such appliances up to about 13,500 kW.

Revo "Paisley" units on "Zealand" standards outside the Accrington Police and Fire Station buildings

Austria.—HYDRO-ELECTRIC PROGRESS.—Some particulars are given in a recent issue of the *Electrotechnische Zeitschrift* of the hydro-electric station which has recently been completed at Mallnitz for the supply of power to part of the electrified sections of the Austrian Federal Railways. The plant comprises two 5,000-h.p. Pelton-type turbines working under a head of about 1,020 ft. and coupled direct to 6,000-V, 500-r.p.m. alternators. Each set is connected to an outdoor transformer which steps up the power for transmission purposes to a pressure of 58,350 V.

Aylesbury.—CHANGE-OVER.—The Town Council is to change over the system of supply in a portion of Cambridge Street at an estimated cost of £759, to be defrayed out of revenue.

Barrow-in-Furness.—TO ENCOURAGE ELECTRIC COOKING.—The Electricity Committee has adopted the electrical engineer's recommendation that provision shall be made in houses under construction for the necessary wiring between the main cut-out and the position in which a cooker would be fixed, free of charge to the builder.

SUPPLY EXTENSIONS.—The Electricity Committee has agreed to provide a supply to premises at Rampside, Dalton, Crake Valley and Pennington.

Berkhamsted.—REDUCED CHARGES.—The charges for electricity in the rural area have been reduced by the Aylesbury Corporation from 9d. to 8d. per kWh for lighting and from 10d. to 9d. for slot-meter users.

Blackpool.—NEW EQUIPMENT.—The Electricity Committee recommends that sums of £17,000 and £5,000 be provided out of net surplus revenue for the development of the electricity works and the replacement of old switchgear and equipment in old transformer houses with switches of a larger capacity.

Bromley.—REDUCED CHARGES.—The Town Council has reduced the charge for power to a flat rate of 1d. per kWh, instead of 1½d., for the first 3,000 kWh per quarter, and 1d. beyond. For cinemas and theatres the charge of 2½d. per kWh flat rate is to remain, with an alternative tariff of a standing charge, including meter rent, of £11 per annum per kW of demand, plus a "unit" charge of ¾d. For the hire of cookers the quarterly charges of 11s., 9s. and 7s. 6d. are reduced to 7s. 6d., 6s. and 5s. respectively.

Burnley.—CHANGE-OVER.—For the change-over to a.c. the Town Council is purchasing cable costing £3,273.

Chesterfield.—LOAN.—The Town Council has applied for a loan of £64,500 for extending the generating plant at the Chatsworth Road power station.

DUPLICATE SUPPLY.—The Electricity Committee is to provide a duplicate supply to the Chesterfield Tube Co., Ltd., and to the Derby Road area at a total estimated cost of £1,520.

NEW CABLES.—The Committee is also to lay cables and undertake the requisite incidental works in connection with a supply to the western area of the borough at an estimated cost of £2,310.

Clitheroe.—SUPPLY EXTENSION.—The supply of electricity is to be extended to Downham by underground cables. The extra cost, as compared with overhead lines, is being met by Mr. R. C. Assheton.

Dagenham.—ELECTRICITY FOR COUNCIL HOUSES.—The Urban District Council is asking the London County Council to receive a deputation to discuss the supply of electricity to the houses on the L.C.C. estate at Dagenham. About 10,000 of the older houses are at present lighted by gas.

Doncaster.—REDUCED CHARGES.—An all-round reduction in the charges for electricity has been approved by the Borough Council. The reductions are: Domestic tariff, fixed annual charge of 10 per cent. of the rateable value, plus ½d. per kWh (against same annual charge plus ½d. per kWh summer and ¾d. per kWh winter); lighting flat rate, first 500 kWh at 4d., all over 500 per quarter at 3½d. (flat rate of 4d. per kWh); maximum demand tariff, £12 per annum per kW installed, plus 1d. per kWh (£12 10s., plus 1½d. per kWh); prepayment meters, 4½d. per kWh (5d.); theatres and cinemas, 2d. per kWh (2½d.).

Dover.—HIRE-PURCHASE OF APPLIANCES.—The Town Council has decided to finance the hire-purchase scheme for electric appliances at the new showrooms to the extent of £1,000 out of the surplus revenue. At the end of a year the further financing of the scheme will be considered.

Ellesmere Port.—ELECTRICITY IN COUNCIL HOUSES.—The Council has discussed with the Mersey Power Company the question of installing electricity in houses now using gas, and has decided not to raise any objection to the installation of electricity by tenants of present or future housing estates on any terms which suit their convenience, provided its interests in all respects are generally safeguarded.

Formby.—CHANGE-OVER.—At a recent meeting of the Formby Council a letter was read from the Lancashire Electric Power Co. stating that the transmission lines from Ormskirk to Formby were now complete and that a test had been made with satisfactory results. Preparations have been made for the change-over to take place on July 15th.

Hazel Grove and Bramhall.—REVISED CHARGES.—The Urban District Council has adopted the following amended scale of charges: Lighting, two winter quarters, first 24 kWh per quarter 6d. per kWh, beyond 5d.; summer quarters, first 12 kWh per quarter 6d., beyond 5d.; power, heating and cooking, winter quarters 1½d. per kWh, summer quarters 1d.

Horsham.—REDUCED CHARGES.—The Urban District Council has reduced the charge for lighting from 8d. per kWh to 7½d., and for power and heating from 2d. to 1½d. per kWh, in the rural districts.

Ilfracombe.—ILLUMINATION PROPOSAL.—The Urban District Council has declined an offer by the Electric Light Co. to supply electricity for sea-front illuminations at an annual charge of £120, plus a "unit" charge of 1½d., and will take a supply this year on the public lighting sliding scale. The Council is to apply to the Electricity Commissioners for an Order enabling it to generate and distribute electricity for public lighting in all or any of the public pleasure grounds within its area.

Italy.—AN ELECTRO-CHEMICAL WORKS.—In a recent issue of the *Revue Générale d'Electricité* a lengthy description is given of the large new electro-chemical works at Porto Marghera, Venice, which has recently been completed by the Società San Marco. The plant, which is mainly devoted to the electrical production of calcium carbide, cyanamide, and ferro-alloys, comprises two Miguet-Perron electric furnaces, each requiring 16,000 kVA, supplied by two 32,000-kVA Scott-type transformers built by the Société Savoisienne de Constructions Electriques, of Aix-les-Bains, France. The transformers step down 10,000-V 42-cycle power taken from the system of the Società Adriatica di Electtricità to 25-55 V.

Leeds.—LOAN.—The Electricity Committee is seeking sanction to borrow £30,000 for the assisted-wiring scheme.

HIRE-PURCHASE TERMS.—The period of repayment for the hire-purchase of cookers issued by the Electricity Department is to be extended from three to five years, the repayments to be made in quarterly instalments at the rate of 1s. per £ of the retail list price.

Lichfield.—OVERHEAD LINES.—The Rural District Council has consented to the erection of overhead lines at Longdon by the Trent Valley & High Peak Electricity Co., and from Shuttington to Statfold by the Tamworth District Electric Supply Co.

Littleborough.—LOAN.—The Council proposes to borrow £1,000 for mains and £500 for domestic apparatus.

Liverpool.—AIRPORT LIGHTING SCHEME.—Sanction is being sought from the Air Ministry and the Ministry of Health for a proposal to proceed with the floodlighting, boundary

lighting and obstruction lighting at the Liverpool Airport at a cost of £6,500.

SPECIAL ORDER.—Application is being made for a Special Order to extend the area of supply of the Corporation to Simonswood in the West Lancashire Rural District Area. Should the Order be granted, the following expenditure will be incurred: Erection of overhead supply line, £1,059; low-voltage line, £1,600; sub-station equipment, £400.

LOAN SANCTIONED.—Sanction has been obtained to borrow £300,000 for unspecified extensions of mains.

Maidstone.—MAINS EXTENSIONS.—The Town Council is to carry out mains extensions to Leybourne Triangle at an estimated cost of £1,350, and other extensions at Willington and Fauchon's Lane.

Manchester.—TARIFF REDUCTIONS.—The Electricity Committee recommends various reductions in charges involving concessions estimated at £100,000 per annum.

In connection with the proposed plant extensions, the Committee states that the estimated costs of the plant required are as follows: 30,000-kW turbo-alternator, condensing plant and pumps, £95,000; a boiler with an evaporating capacity of 130,000 lb. per hour, £33,000; a concrete cooling tower for cooling 1½ million gallons of water per hour, £15,000; high- and low-pressure pipework and feed tanks, £23,000; auxiliary transformers, switchgear and cable work, £4,500; ash removal plant, £2,000; and civil engineering work in boiler and turbine houses, £7,500; making a total of £180,000.

Melton Mowbray.—PURCHASE OF UNDERTAKING.—The Urban District Council has decided that the charge reductions offered by the Melton Mowbray Electric Light Co. are inadequate and do not warrant the waiving of the option to purchase the undertaking.

Morocco.—INCREASE IN THE DOMESTIC LOAD.—According to M. J. Cuenot, the engineer of the Société Marocaine de Distribution d'Eau, Gaz et Electricité, since the adoption of low tariffs for power supply about two years ago there has been a marked development in the use of electric cooking apparatus in Morocco. M. Cuenot estimates that there are now in use in the country about 550 electric cooking stoves and ovens and nearly 400 electric hot-plates, the majority being in the Casablanca district.

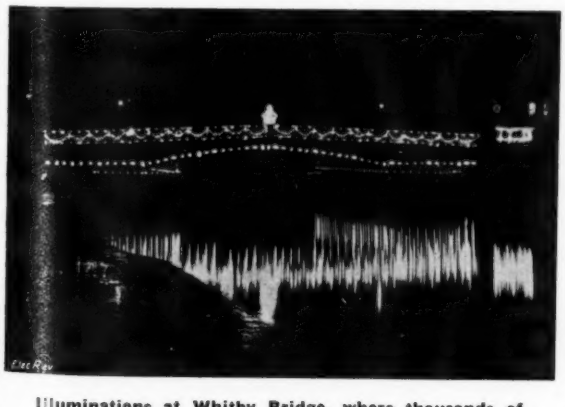
Northampton.—ELECTRICITY FOR COUNCIL HOUSES.—The Housing Committee has had under consideration the question of the installation of electric lighting in 991 Council houses not so fitted, and the Ministry of Health has suggested that the cost of the installation should be met by the raising of a loan. It was decided to make arrangements to seek sanction to borrow £6,415.

Reigate.—OVERHEAD LINE.—The Town Council has decided to raise no objection to the erection of an overhead line from Woodhatch Road to Lonesome Lane, across agricultural land, by the Horley & District Electricity Supply Co., Ltd.

Romford.—GAS-DISCHARGE STREET LIGHTING.—The Urban District Council has adopted the "Osira" system of street lighting, to be carried out by the County of London Electric Supply Co., Ltd., at an estimated cost of £7,163.

Rotherham.—REDUCED CHARGE.—The Electricity Committee recommends a concession of 25 per cent. off the scale lighting charge for electricity supplied to churches, &c.

Scarborough.—NEW PLANT.—The electrical engineer has submitted a scheme for improving the electric lighting of Crossgates in the Seamer area at a cost of £7,267 by the provision



Illuminations at Whitby Bridge, where thousands of "Beeantee" holders were used

of an 11,000-V cable and plant. Application is to be made to the Electricity Commissioners to borrow this amount.

ILLUMINATIONS.—The Electricity Illuminations Committee recommends a number of schemes for lighting by electricity either by floodlighting or strip-lighting at a total cost of £2,421.

South Africa.—EXTENSION ON THE RAND.—A new agreement has been concluded between the Victoria Falls and Transvaal Power Co., Ltd., and various Rand mining groups for supplies of electricity, which will mean a considerable saving to the groups. The price will now be about a third of a penny per kWh for power. The reduction follows the official approval recently received for the erection of the new Klip power station by the Electricity Supply Commission, which will have an initial capacity of 106,000 kW. Provision has been made for extensions from time to time, as demand increases, until it reaches a capacity of 350,000 kW. The entire output will be purchased by the Victoria Falls Co. and fed into its existing system. Owing to the recent rapid development of mining activities, the demand for electricity is such that before the 106,000-kW stage is completed an extension may be found necessary.

Stone (Staffs).—REDUCED CHARGES.—The Urban District Council has made the following reductions in charges: Ordinary lighting, from 7d. to 6d. per kWh; prepayment meters, from 8d. to 7d.; shop and hotel lighting, from 7d. to 6d., and from 4½d. to 4d., with an alternative tariff of £3 per kW per quarter of maximum demand, plus 1½d. per kWh. Heating and cooking for business premises, a new tariff at 2d. per kWh for the first 240 kWh, and 1d. beyond; power, reduction of ¼d. per kWh throughout the present scale, multipart tariff, "unit" charge for first 240 kWh reduced from 1½d. to 1d., all beyond to be at ¾d.

An illuminated fountain erected in the Avenue de l'Opéra for the Grande Semaine de Paris

Sutton Coldfield.—ELECTRICITY FOR COUNCIL HOUSES.—The Electricity Committee is to install electricity services at Council houses in Grange Avenue and Withy Hill Road.

Tonbridge.—MAINS EXTENSIONS.—The Urban District Council has decided to extend its mains to supply bungalows now being erected in Shipbourne Road, at an estimated cost of £900.

BULK SUPPLY.—A loan of £12,700 for the bulk supply extension from Tunbridge Wells has been applied for.

Torquay.—BULK SUPPLIES.—The Electricity Committee has arranged to afford a supply to the Paignton Electric Light & Power Co., Ltd., at an additional point on the main transmission line *via* Ipplepen, subject to the company bearing the cost and to the necessary variation of the bulk supply agreement; a supply to the Brixham Gas & Electricity Co., Ltd., at White Rock; and to the Teignmouth Electric Lighting Co., Ltd., at Ullcombe, upon the usual terms.

Tunbridge Wells.—LOAN.—The Town Council has applied for a loan of £5,786 for a cable from the central generating station to the Tonbridge urban boundary at Southborough. A trunk main is to be laid owing to the growth of the supply taken by Tonbridge Urban District Council.

Wakefield.—NEW PLANT.—The Electricity Committee has obtained sanction to borrow £1,000 for the provision of additional reactors and switchgear at the generating station.

Wallasey.—UNDERCHARGED BULK SUPPLY.—Wallasey's claim against Birkenhead regarding an undercharge for bulk supplies of electricity extending over the past four years is understood to be between £3,000 and £4,000. At the Birkenhead Council meeting the chairman of the Electricity Committee stated that Birkenhead paid Wallasey on the basis of the calorific value of coal. If the Wallasey people had made a mistake, he doubted whether they were entitled to pass on the extra charge after the lapse of such a period. Negotiations are proceeding between the parties.

Watford.—SUB-STATION AND COOLING TOWER.—The Electricity Committee recommends the purchase of a site at Adeyfield Road, Hemel Hempstead, for the erection of a sub-station. It also proposes to erect a cooling tower at the electricity works at an estimated cost of £3,000.

Wolverhampton.—EXTENSIONS.—The Electricity Committee is to provide a supply to houses to be erected on the Aldersley Estate, at a total estimated cost of £5,679, and mains extensions are to be undertaken at a cost of £3,985.

Workington.—REDUCED CHARGES.—The Electricity Committee recommends that the charge of ¾d. per kWh under the domestic scale shall be reduced as from October 1st next to ½d. This does not apply to business premises.

Traction

Doncaster.—TRANSPORT UNDERTAKING'S RESULTS.—A net loss of £2,642 was made by the Corporation tramway system during the financial year ended March 31st, making the total deficit on the tramways revenue account £13,308. This loss, however, was more than offset by the net profit of £5,011 made on the trolley vehicles.

NEW TROLLEY-BUSES.—The Town Council has decided to purchase four additional trolley vehicles.

London.—TRANSPORT RECEIPTS.—The receipts of the London Passenger Transport Board for the first twelve months of working—to Saturday, June 30th—totalled £26,505,100. The receipts for the week ended June 30th amounted to £546,500, compared with £542,200 for the preceding seven days.

The new showrooms of the Darwen Corporation Electricity Department (See page 58)

Switzerland.—RAILWAY ELECTRIFICATION.—On August 15th next the 52-mile line from Berne to Lucerne is to be opened to electric traction. The conversion has been proceeding since 1932. On the same day the electric service over the Biel-Sonceboz line, whose conversion was noted in the ELECTRICAL REVIEW of May 25th, is to be extended from Sonceboz to La Chaux de Fonds, a distance of 18 miles.

Traffic Signals.—A large scheme is projected for the installation of vehicle-actuated traffic signals in the area enclosed by Edgware Road, Oxford Street, Tottenham Court Road, and Marylebone Road. Tenders have been invited, and the scheme will cost about £30,000.

The Gateshead Town Council is applying to the Ministry of Transport for sanction to erect traffic signals at the foot of West Street.

The Chesterfield Watch Committee is to consider further the question of the installation of traffic signals in various positions in the borough.

The Guildford Town Council proposes to erect vehicle-actuated traffic signals at four junctions (£1,384).

The Wallasey Works Committee is to install vehicle-actuated traffic signals at the Victoria Road junction.

Turkey.—NEW ELECTRIC RAILWAY.—The construction of an electric railway line between Zongouldak and Eregli will soon begin, reports *Reuter's Trade Service* from Istanbul. A technical mission of experts from the Ministries of National Economy and Public Works is shortly leaving for Zongouldak to investigate matters on the spot. The new railway, which will take two years to complete, will link the coal basins of the district.

Communications

Australia.—DEVELOPING THE TELEPHONE.—The Australian Telephone Development Association, limited by guarantee, has been registered in Sydney to further the development, use, manufacture, and improvement of telephones, telegraphs and radio communication.

France.—NEW HIGH-POWER STATIONS.—The French regional scheme is progressing rapidly. According to the *Wireless World* Paris correspondent, the new State station at Villebon-sur-Yvette, near Paris, is rapidly approaching completion. The buildings will include the new P.T.T. transmitter and the Colonial station, which will be transferred from its present site at Pontoise. The Northern station at Camphin-en-Carembault (Lille), begun on March 28th last, is at the first-storey stage. It is possible that both this and the Paris P.T.T. station may be working before the end of the year.

WIRELESS LISTENERS.—The number of wireless sets in France declared up to April 30th, 1934, is 1,554,295, 58,469 of which are crystal sets and 1,472,333 privately owned valve sets, according to a statement in *World Radio*.

Germany.—PREPAYMENT TABLE TELEPHONES.—According to *Hamburger Nachrichten*, the German Post Office has introduced a simple type of prepayment telephone for the use of those subscribers who seldom require trunk service yet wish to collect payment for local calls as they are made. The apparatus comprises a hand-microphone table set with dialling attachment and a small renter's box arranged to take a 10-pf. piece (about 1½d. at par) for each local call. Fire and accident calls can be made at any time without payment, but trunk and other special services are only available by the use of a special key entrusted to the renter. The renter empties the coin box and is personally responsible for the usual monthly accounts plus a surcharge for the special apparatus. As the set is easily portable and is connected by a flexible cord, it is suitable only for use in family or other trustworthy circles.

Great Britain.—RADIO RELAY SERVICES.—The Burnham-on-Sea Urban District Council has entered into a ten years' agreement with Christy Bros. for the establishment of a relay station. The firm is to pay the Council a minimum of £200 per annum. The local wireless dealers advocated that tenders should be invited for the concession.

TELEPHONE TO PALESTINE.—The Postmaster-General announces that the telephone service to Palestine has been extended to Tel-Aviv, Bethlehem, Jericho.

Japan.—TOKIO-FORMOSA WIRELESS TELEPHONE SERVICE.—The new wireless telephone service between Tokio and Formosa was formally inaugurated on Tuesday, when Mr. Nagai, the Overseas Minister, exchanged congratulatory messages with the Governor-General of Formosa. The service is a prelude to the wireless telephone links which it is hoped to open in October between Tokio and London, Paris and New York.—*Reuter* (Tokio).

HIGH POWER BROADCASTING STATIONS.—We understand from the *Wireless World* that three 150-kW broadcasting stations at Tokio, Osaka, and Kyosho are to be built by the Japanese Broadcasting Company, and State credits to the extent of £1,623,000 have been granted. From ten to fifteen low-power regional stations are to be built, and the work will take about five years.

The Manchester and Liverpool Tramways

IN spite of a decrease in the number of passengers carried from 334,779,964 to 328,683,785, the Manchester Corporation Transport Department's report for the year ended March 31st shows an increase in revenue of £77,443. The improvement coincides with the shortening of the fare stages, although during the last few months of the year the number of passengers carried began to rise. In presenting the financial statistics for the tramways, the general manager, Mr. R. Stuart Pilcher, shows that the revenue was £1,421,545 (£1,427,252 last year), the working expenses £1,099,560 (£1,153,814), and the net profit £99,175 (£48,665). Receipts per car-mile were 17.036d. (17.184d.), expenses 15.755d. (16.523d.), the price of electricity having been reduced from 0.811d. per kWh to 0.806d.

In the case of the tramways the car mileage was 20,026,744 (19,934,208) and the number of passengers carried was 232,930,681 (248,518,259). Although there was a decrease in revenue due to the conversion of routes to bus operation, on the routes not converted an increase of £8.107 was shown.

Expenditure on track work, including 3¼ miles of reconstruction, totalled £32,781, and no new cars were built, 817 being in stock. During the year the Trafford Park Estates, Ltd., leased its tramways to the Manchester Corporation.

The development of co-operation in municipal passenger transport in the Manchester area reached a definite stage during the year, when a memorandum embodying the reports of the general managers, town clerks, and treasurers of Ashton-under-Lyne, Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stalybridge, &c., Joint Board, and Stockport was prepared by a conference of representatives of the authorities concerned. The conference passed a resolution referring the reports to the authorities and asking them to consider the same and to state if they were in favour of the formation of a joint municipal transport board. The Manchester Corporation has agreed.

An Improvement at Liverpool

The traffic returns of the Liverpool Corporation show that the total tramway receipts were £1,293,141, which is £2,910 higher than for the previous year; the mileage decreased from 19,743,246 to 19,649,175, while the number of passengers carried increased from 240,421,392 to 243,949,677. During the early part of the year there was a very considerable reduction in the number of passengers carried, and the decrease in the average receipts per passenger per journey has continued throughout the year. This is the first time there has been an increase in the number of passengers carried on the trams since 1929, and the motor buses have shown a steady decline throughout the year.

Financial statistics show that the total revenue (trams) was £1,348,293 (£1,332,565), the working expenses were £1,078,608 (£1,093,207), and the net surplus £155,438 (£126,877). The cost of electricity was reduced by 0.1d. per kWh as from October 1st, 1933, but even with this reduction the general manager, Mr. W. G. Marks, considers that the charge is excessive. The City Council has voted £250,000 for the provision of new rolling stock, and forty-eight bogie cars of a new type have been ordered. The expenses per car mile were 14.43d. (14.66d.) and the earnings 15.79d. (15.78d.), the length of track operated being 164 miles.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Argentina.—BUENOS AIRES.—July 26th. State Oilfields. Two electric pumping sets for the fire-extinguishing installation at Santa Fé. (G.Y. 14002.)*

Australia.—MELBOURNE.—August 28th. Posts and Telegraphs Department. Various types of telephone relays. (A.Y. 12462.)* September 4th. Vitreous resistances. (A.Y. 12473.)* Telephone switchboard plugs and sleeves. (A.Y. 12472.)* August 14th. Loading coil pots. (A.Y. 12426.)* August 20th. State Electricity Commission of Victoria. 10,000-kVA transformer complete with spare coils and bushings. (A.Y. 12460.)*

Belfast.—August 4th. Electricity Department. One 30,000-kW turbo-alternator and step-up transformers. (June 29th.)

Bexhill.—July 27th. Electricity Department. Paper insulated cables for one year commencing August 7th, 1934. (See this issue.)

Birtley (Co. DURHAM).—July 22nd. Parish Council. Erection of forty gaseous discharge lamps and overhead extensions on a new housing estate. (See this issue.)

Canterbury.—July 23rd. Kent County Mental Hospital Visiting Committee. Rectifier plant and switchgear at mental hospital, Chartham. (July 6th.)

China.—Government Purchasing Commission. Wire, insulators, telephone apparatus and other material. (July 6th.)

Devon.—July 28th. Standing Joint Committee. Supply during 1935, 1936 and 1937 of police accoutrements, comprising electric lamps, &c. Form of tender from Chief Constable of Devon, Exeter; tenders to Clerk to the Committee, The Castle, Exeter.

Dover.—July 20th. Corporation. Complete equipment of two Scott-connected transformer chambers. (June 15th.)

Egypt.—CAIRO.—August 15th. Ministry of the Interior. Single-phase, single-tariff meters. (A.Y. 12440.)* August 14th. Materials in connection with the installation of a distribution sub-station at Galioub. (A.Y. 12476.)* August 4th. Electrical material in connection with a distribution sub-station at Barrages and transmission lines between Kaha and Barrages. (A.Y. 12468.)*

Enfield.—July 20th. U.D.C. Closed-circuit non-interfering successive type of code-signalling fire alarm system. Specifications from Clerk, Public Offices (deposit £2 2s.).

India.—SIMLA.—July 20th. Bombay, Baroda and Central India Railway Co. Motor-driven air compressor. (July 6th.)

London.—EAST HAM.—July 19th. Education Committee. Installation of electric lighting in three schools. Specifications from Secretary, Education Office, Town Hall, (deposit 10s.).

Long Eaton.—July 24th. Electricity Department. Two 275-kW mercury-arc rectifiers and two e.h.p. truck-type switch cubicles. (See this issue.)

Milford Haven.—July 17th. Electricity Department. Overhead line materials, wood poles, &c. (July 6th.)

Newport (Mon.).—August 13th. Electricity Department. Two water-tube boilers, with superheaters, &c. (See this issue.)

New Zealand.—WELLINGTON.—Post and Telegraphs Department. August 15th. 1,000 50-V telephone switchboard lamps. (A.Y. 12452.)* 50,000 dry cells for telephone use. (A.Y. 12455.)* August 20th. 750 microtelephone handles. (A.Y. 12453.)* Public Works Department. August 21st. Sixteen 300-W outdoor station lighting fittings. (G.Y. 13999.)*

Rickmansworth.—July 30th. U.D.C. Two installations of electrically driven submerged centrifugal pumps. Specifications and form of tender from Sandford Fawcett & Partners, 53, Victoria Street, S.W.1 (deposit £3 3s., made payable to the Rickmansworth U.D.C.); tenders to S. A. Bateman, clerk to the Council, Council Offices.

Roxburgh.—July 23rd. County Council. Various works, including electrical, at Newcastleton School. Schedules from, and tenders to, County Clerk, County Offices, St. Boswells.

Somerset.—County Council. Installation of a system of synchronised electric clocks at the new County Offices, Taunton. (July 6th.)

South Africa.—CAPE TOWN.—July 25th. Electricity Department. Overhead line material. (G.Y. 13952.)* August 8th. Street-lighting fittings. (G.Y. 14017.)* ERMELO.—Municipality. August 1st. Electric motors, rotary convertors, and ceiling fans. (A.Y. 12461.)* Eight transformers. (A.Y. 12456.)* P.i. l.c. steel-tape-armoured cables. (A.Y. 12463.)* JOHANNESBURG.—Government Supplies Board. August 3rd. 1,000 magneto table telephones. (A.Y. 12464.)* Railways and Harbours. August 13th. Electric lamps required during the year 1935. (A.Y. 12475.)* PRETORIA.—Government Supplies Board. August 3rd. Telegraph and telephone line material. (G.Y. 14013.)* August 17th. Telephone terminal blocks, indoor-type protectors fitted with carbons and fuses, and plunger or lever holddown type switches. (A.Y. 12471.)* WORCESTER.—August 1st. Municipality. Steam turbine, d.c. generator and vertical steam boiler. (A.Y. 12420.)*

Southampton.—August 21st. Electricity Department. One 25,000-kW turbo-alternator and two 160,000-lb. boilers. (See this issue.)

Southport.—July 26th. District Water Board. Two electrically driven centrifugal deep-well pumps, &c. Specifications and forms of tender from C. Burton Ede, engineer, 14, Portland Street (deposit £3, payable to the Board).

South Shields.—July 23rd. Electricity Department. One 600-kVA group of Scott-connected transformers with automatic voltage regulation. (July 6th.)

Sunderland.—Town Council. Passenger lift at the Town Hall. Plans by T. P. Collinge, Borough Engineer, Town Hall.

Swansea.—August 3rd. Electricity Department. Auxiliary switchgear for Tir John power station. (July 6th.)

Tynemouth.—July 23rd. Electricity Department. One 250-kVA and one 500-kVA transformers. (See this issue.)

Uruguay.—MONTEVIDEO.—July 27th. State Electricity Supply and Telephones Administration. Bare copper conductors and telephone lines. (G.Y. 13853.)*

Walthamstow.—July 27th. Electricity Department. Electrically heated water installations at the electricity offices and showrooms. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Barrow-in-Furness.—Electricity Committee. Accepted. 500 switch cut-outs.—British Insulated Cables, Ltd. Cooker control units.—J. A. Crabtree & Co., Ltd.

Blackpool.—Electricity Committee. Accepted. Switchboards.—Switchgear & Cowans, Ltd. Traffic signals.—Forest City Electric Co., Ltd.

Chesterfield.—Electricity Committee. Recommended. Cables (£1,868).—Macintosh Cable Co., Ltd. Switchgear (£352).—Switchgear & Cowans, Ltd.

Dover.—Town Council. Accepted. Alterations and replacement of apparatus on consumers' premises owing to the change-over (£578).—Collins' Electrical, Ltd.

Leeds.—Electricity Committee. Accepted. Switchgear for Whitehall Road sub-station (£1,241).—A. Reyrolle & Co., Ltd. Cables.—Enfield Cable Works, Ltd. (£545); Macintosh Cable Co., Ltd. (£1,640); Metropolitan Electric Cable & Construction Co., Ltd. (£2,158); Hackbridge Cable Co., Ltd. (£541); Telegraph Construction & Maintenance Co., Ltd. (£659).

Manchester.—Electricity Committee. Accepted. Conduits and accessories for wiring.—L. Andrew & Co., Ltd. Insulating cloth.—Hamnet & Andrew. Street lanterns.—Wardle Engineering Co., Ltd. Service boxes.—Forest & Sym, Ltd.; Sykes & Dyson, Ltd.; W. Lucy & Co., Ltd. Service cut-outs.—Parmiter, Hope & Sugden, Ltd. Tail-end boxes.—Johnson & Phillips, Ltd.; Sykes & Dyson, Ltd. Wire.—Ward & Goldstone, Ltd.; London Electric Wire Co. & Smiths, Ltd.; E. & E. Kaye, Ltd. Education Committee. Accepted. Cable.—W. T. Glover & Co., Ltd.

Northern Ireland.—BELFAST.—Estates Committee. Accepted. Installation of electric lighting in 178 houses on housing sites (£862).—D. Gamble & Co.

Shrewsbury.—Town Council. Accepted. Vehicle-actuated traffic signals.—Automatic Electric Co., Ltd. Fixed time traffic signals.—Chance Bros. & Co., Ltd.

Sutton Coldfield.—Electricity Committee. Recommended. Switchgear, transformers and kiosks (£1,438).—General Electric Co., Ltd.

Watford.—Electricity Committee. Recommended. Switchgear (£408).—Metropolitan-Vickers Electrical Co., Ltd. Overhead line equipment (£350).—W. T. Henley's Telegraph Works Co., Ltd.

Worthing.—Electricity Committee. Accepted. Switchgear for Sompting sub-station (£525).—Switchgear & Cowans, Ltd. Pier Committee. Accepted. Lamps and switchboards for pavilion (£194).—Grierson, Ltd.

A Travelling Film Studio Unit

A PORTABLE studio and generating unit has been put into service by Revelation Films, Ltd. This consists of a Dennis four-ton sliding-roof body with accommodation for four men apart from the driver. The total weight of the truck fully loaded is 8 tons 6 cwt., including that of the generating set, 2 ton 10 cwt. Its cruising speed is 30 m.p.h.

The "Super Parvo Debrie" electrical equipment includes a camera with interchangeable synchronous motor, and a 24-V interchangeable d.c. motor with regulating resistance and 36-Ah battery. The 100-h.p., 1,200 r.p.m. 4-cylinder petrol engine drives a double-commutator 56-kW three-wire d.c. generator through a pin-type leather-insulated flexible coupling. Each system of the dual ignition (6-V coils) is independent and the battery is not connected to any other circuit. A Lucas 12-V starting motor is mounted on a welded steel platform. The steel-panel switchboard is equipped with two moving-coil voltmeters (0-150 V), two ammeters (0-350 A), two 400-A s.p. overhead circuit breakers, and a field rheostat. Connections for outgoing circuits are mounted on an oak frame at the back of the switchboard.

The lamps comprise six 3-kW twin broadsides, and six 2-kW and two 5-kW spots. All their stands are interchangeable and those for the 5-kW lamps are of the self-sustaining telescopic type. The whole equipment (which is illustrated on page 66) is designed to be put into full operation, including the assembly of the portable cables, within fifty minutes. The generator and lamps were made by Messrs. Pulver & Co., Ltd.

Notes

The Institute of Metals

The twenty-sixth annual autumn meeting of the Institute of Metals is to be held in Manchester from September 3rd to 6th. Apart from civic and social functions and excursions, a series of visits to works is being arranged, including those of the Broughton Copper Co., Ltd., the Metropolitan-Vickers Electrical Co., Ltd., W. T. Glover & Co., Ltd., Mather & Platt, Ltd., British Copper Refineries, Ltd., British Insulated Cables, Ltd., Callender's Cable & Construction Co., Ltd. (Leigh), and the Chloride Electrical Storage Co., Ltd. Eighteen papers are to be presented for discussion, among them being one on "Some (Magnetic) Properties of Heavy Cold-Worked Nickel," by Mr. H. Quinney.

Current Loading of Paper-insulated Cables

In 1924 the British Electrical & Allied Industries Research Association issued Ref. F/T14: "Tables of Permissible Current Loading of British Standard Impregnated Paper-insulated Electric Cables (B.S.S. No. 7, 1922) with Explanatory Notes," in which were given current ratings of cables based on the dimensions specified in B.S.S. No. 7: "Insulated Annealed Copper Conductors for Electric Power and Light including Voltage Tests." B.S.S. No. 7 has been superseded by B.S.S. No. 480: "Dimensions of Metal-Sheathed Paper-Insulated Plain Annealed Copper Conductors for Electricity Supply, including Voltage Tests." The revision of Ref. F/T14 to take account of changes in rating arising out of changes in dimensions, new sizes and types of cable is under consideration. Pending the completion of this work it may be assumed that any changes in rating arising out of the present changes in dimensions only will be very small, amounting to 5 per cent. only in rare cases. Subject to the qualifications described in Ref. F/T14 respecting the thermal resistivity of the dielectric and the soil, temperature limits, depth of laying, etc., the current ratings for the cables covered by B.S.S. No. 480 (460, 1,000 and 1,500 V) may be assumed to be similar to those for 660-V cables of the same type and construction in Ref. F/T14.

Wireless from the Mains

On July 4th a Bill was presented to the House of Commons by Mr. W. S. Liddall, M.P. for Lincoln, the object of which is to remove the doubt which exists as to the powers of authorised undertakings to permit the use of their electricity supply systems for the transmission of wireless programmes. Under the system proposed three simultaneous programmes can be relayed over the existing distributors. The existing companies which relay one or two programmes over specially erected overhead wires do so by arrangement with the local authorities and under licence from the Postmaster-General. Those which operate under the "electric mains rediffusion" system now proposed will also need the licence of the Postmaster-General and will equally operate under his supervision. The broadcast matter relayed will be received from any public broadcasting station or any broadcasting station approved by the Postmaster-General; provision is made in the Bill to avoid the reception of unwanted advertising matter. The new system has been developed with the co-operation of the Liverpool Corporation for British Insulated Cables, Ltd., by Capt. P. P. Eckersley (formerly chief engineer of the B.B.C.) and was successfully demonstrated in Liverpool during the Convention of the Incorporated Municipal Electrical Association (ELECTRICAL REVIEW, June 1st). It is claimed that disturbances caused by electric tramways, lifts and motors, will be eliminated by this system.

Generation of Electricity in June

The Official Returns rendered to the Electricity Commissioners show that 1,049 kWh was generated by authorised undertakers in Great Britain during the month of June, 1934, as compared with the revised figure of 885 million kWh in the corresponding month of 1933, representing an increase of 164 million kWh, or 18.5 per cent. The number of working days in the month (*i.e.*, excluding Sundays and Bank Holidays) was 26 against 25 last year.

During the first six months of 1934 up to the end of June 7,630 million kWh was generated as compared with the revised figure of 6,495 million kWh for the corresponding period of 1933, representing an increase of 1,135 million kWh, or nearly 17.5 per cent. The following table gives the figures for the first six months of the year:—

	1933. kWh (millions)	1934. kWh (millions)	Inc. per cent.
Jan.	1,336	1,536	14.8
Feb.	1,151	1,343	16.5
March	1,160	1,390	19.6
April	952	1,187	24.5
May	1,005	1,125	11.9
June	885	1,049	18.5

Power Station Extensions

The Central Electricity Board has received the approval of the Electricity Commissioners to extensions to selected stations. Orders for 500,000 kW of generating plant to the value of between £4,000,000 and £5,000,000, will be placed within the next few months. Directions have already been issued by the Board for plant in the following municipal stations:—

Undertaking.	Station.	Turbo-alternators. kW.	Boilers. lb. per hour.
Sheffield ...	Blackburn Meadows .	1 × 30,000	3 × 150,000 + 2,000,000 gal. cooling tower.
" ...	Neepsend	1 × 30,000	3 × 150,000
Hull	Hull	1 × 25,000	—
Leeds	Kirkstall	—	1 × 200,000
Bristol	Portishead	—	4 × 130,000
Southampton ...	Southampton ...	1 × 25,000	2 × 160,000
Newport ...	Newport	—	2 × 27,000
Liverpool ...	Clarence Dock ...	—	4 × 200,000

Preliminary details have already been published regarding the proposed extension of North Wilford power station (Nottingham) by one 30,000-kW set and four 175,000-lb. per hour boilers.

Electrical Accidents

One man was killed and four others were injured on Tuesday last when a travelling crane which they were moving came into contact with a 66,000-V line near the Dunston (Newcastle-on-Tyne) power station.

A similar occurrence is reported from Wiltshire, where three men moving a hay elevator received severe shocks from an overhead line. Fortunately none of them was injured.

Appointments Vacant

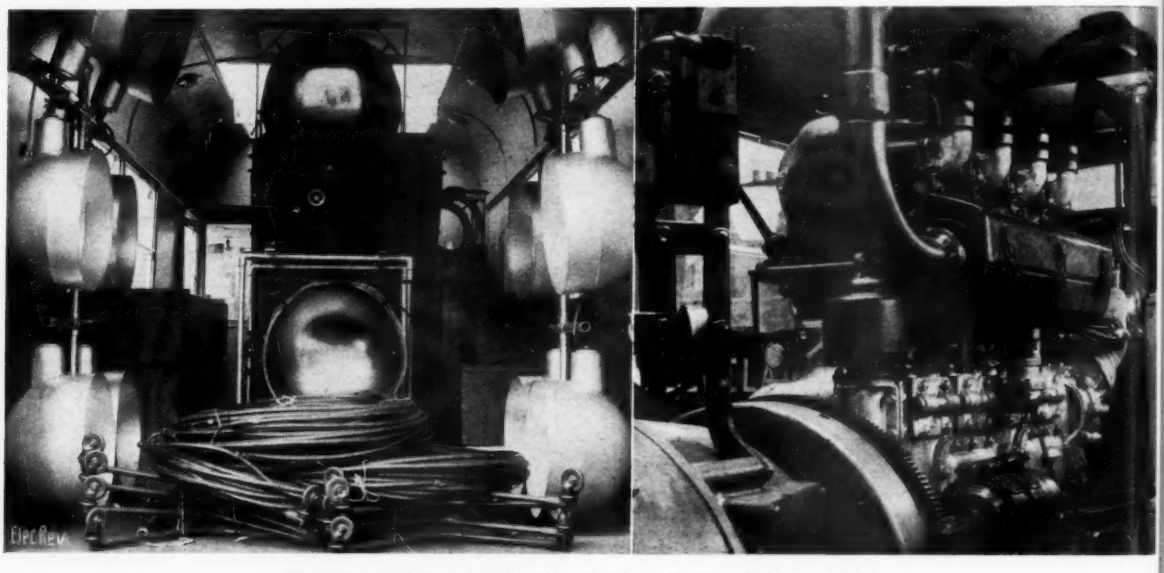
Assistant, grade II, at the Admiralty Technical Pool.

Male or female demonstrator (£180, rising to £240) for Heston and Isleworth Electricity Department.

Personal engineering assistant (£581, rising to £750), for Nottingham Corporation Electricity Department.

Junior mains assistant for Battersea Borough Council.

(See our classified advertisements.)



Two views of the portable film studio unit described on page 65

Makers' Names Wanted

CHRYSTES glassware.
SUPERIOR vacuum cleaner.
ROBUR vacuum cleaner.
ROGERS "vitalator."

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. P. Kemp, M.Sc.(Tech.), M.I.E.E., head of the Polytechnic School of Engineering, Regent Street, W., has been awarded a travelling scholarship by the English-Speaking Union and the City and Guilds of London Institute, and is to pay a visit to the United States and Canada this summer. He will sail on July 28th on the s.s. *Georgic*, returning from New York on September 5th on the s.s. *Majestic*. He will make a tour of various engineering centres, visiting manufacturers, power stations, and technical teaching institutions.

Mr. P. Kemp [*Lafayette*

Mr. E. G. Okell was the subject of expressions of appreciation at last week's meeting of the Plymouth City Council. As we have reported, Mr. Okell is retiring after thirty-eight years' service as city electrical engineer. There have been fifty-nine applications for the post of city electrical engineer, the commencing salary for which is to be £1,100 a year, rising by annual increments of £50 to £1,400. From the list the Electricity Committee have selected seven candidates for interview, and a sub-committee is to visit the undertakings at which these applicants are employed. These include the undertakings at Barking, Blackburn, Coventry, Ilford, Liverpool, Manchester, and Wolverhampton.

Mr. F. Howes, who has for twenty years been with the Electricity Department of Kingston-on-Thames Corporation, has retired, and has been presented by his colleagues with two easy chairs. The presentation was made by the borough electrical engineer, Mr. T. A. Kingham, on July 2nd.

Mr. A. E. Beale, sales manager of the Brompton & Kensington Electricity Supply Co., Ltd., retired on June 30th last owing to continued ill-health, having served the company for over forty-five years.

Mr. A. R. Nissar, consulting electrical engineer, has arrived in London from India on a business visit. His address is c/o Messrs. Thos. Cook & Son, Ltd., Berkeley Street, W.

Mr. J. F. Simpson, borough electrical engineer, Preston, who is retiring next month, received a parting gift from chief officials of the Corporation on July 5th. The presentation was made by the Town Clerk (Mr. H. E. Nutter), and consisted of an inscribed silver tea and coffee service.

Dr. J. L. Miller, Ph.D., A.M.I.E.E., of Messrs. Ferranti, Ltd., has recently had the degree of Doctor of Engineering conferred upon him by Liverpool University for his published contributions to electrical engineering science since 1923. Dr. Miller has, in the past, been engaged in various branches of electrical engineering, but he has become best known for his high-voltage work with Messrs. Ferranti. He will be remembered by many old students of Liverpool University as the University's quarter-mile and cross-country representative in numerous inter-Varsity athletic contests.

Dr. J. L. Miller

Ald. J. Bell was entertained to luncheon on July 6th by the West Midlands Joint Electricity Authority, when appreciation was expressed of the services which he had rendered to the electricity supply industry in the West Midlands for many years. Mr. G. R. J. Parkinson (chairman of the Authority) was in the chair, and supporting him were Messrs. S. T. Allen (manager for the Central England Scheme of the Central Electricity Board), T. A. G. Margary (borough electrical engineer, Wolverhampton), W. A. Jackson (borough electrical engineer, West Bromwich), H. A. Howie (borough electrical engineer, Walsall), H. A. Davies (chairman of the General and Finance Committee), and H. L. Brook (Midland Electric Corporation for Power Distribution, Ltd.). Alderman Bell was presented with a framed copy of a resolution passed by the Authority last May placing on record a tribute to his activities as member from 1922 to 1926, as chairman from 1924 to 1926, of the conference which preceded the establishment of the Authority, and as chairman of the Authority from 1926 to 1934. Accompanying this was a canteen of cutlery, the gift of members of the Authority and chief officials.

Mr. S. M. Catterson, chief engineer of Standard Telephones and Cables, Ltd., and **Mr. H. J. Garnett,** chief engineer of the Telegraph Construction and Maintenance Co., Ltd., are visiting Australia. The two companies have submitted a joint tender for the supply of the telephone cable to be laid between the mainland of Australia and Tasmania, and while in the Commonwealth they will explain to officials of the Postmaster-General's department various alternative proposals which have been submitted. The first-named company has a subsidiary in Standard Telephones & Cables (Australasia), Ltd., and according to Mr. Catterson the wisdom of extending the manufacturing activities of this company will be investigated. The Telegraph Construction & Maintenance Co. has no manufacturing plant in the Commonwealth, but the possibility of establishing one will be considered after Mr. Garnett has submitted reports.

Mr. J. E. Bradfield, Order Department manager of Messrs. W. T. Henley's Telegraph Works Co., Ltd., taking an order by telephone from the company's South African manager in Johannesburg

Loughborough College.—The authorities have announced that the British Empire Scholarships for 1934 in the Faculty of Engineering, Loughborough College, have been awarded to the following: Messrs. C. H. Bray (Wellington College); A. C. Vaughan (Rendcomb College, Cirencester); J. W. Burman (Merchant Taylors' School, Crosby, Liverpool); W. H. Pratt-Johnson (St. George's College, Mussoorie, India); and F. B. Taylor (Aden and Loughborough Junior College). These scholarships are open to all British subjects resident in any part of the Empire, and are of the value of £75 per annum.

Mr. J. Howarth is shortly sailing for Singapore, where he will take up the position of chief engineer in the station of the Indian Broadcasting Corporation. He was formerly a member of the research staff of Messrs. Ferranti, Ltd., and subsequently accepted an appointment on the technical staff of the British Broadcasting Corporation.

Mr. S. P. Ives, electrical and mechanical engineer, has removed to 73, Newman Street, W. (Telephone: Museum 2493.)

Obituary

Mr. T. Mannock.—The death occurred on June 19th, at Broadwood House, Heaton Moor, near Stockport, of Mr. Thomas Mannock, aged eighty-nine. He was formerly for many years in business as an electric crane manufacturer.

Mr. O. Melville.—The death occurred suddenly on July 4th of Mr. Oliver Melville, Tollmount, Kirkcaldy, a member of the Town Council. He commenced business as an electrical engineer over thirty years ago, and became an associate member of the Institution of Electrical Engineers in 1920. He carried through many important schemes, especially in the Fife coalfields. Two years ago he retired to devote his attention to municipal work.

The Rev. G. Gianfranceschi, director of the Vatican wireless station, died in the Vatican City on July 9th, at the age of fifty-nine. He was an assistant of the Marchese Marconi in many of his wireless experiments, and was a director of the Pontifical Academy of Science.

Mme. Curie, whose death we reported last week, was best known to our readers as the discoverer, with her husband Pierre Curie (who died in 1906), of radium. She was born in Warsaw in 1867 and studied in Paris, where she developed an inherited aptitude for scientific research. Following up the investigations of Becquerel, who in 1896 had found that uranium emitted penetrating rays, she demonstrated their atomic character. On the assumption of the presence in uranium of another substance of greater radioactivity, Mme. Curie separated from pitchblende first polonium and then radium; the latter was found to possess more than a million times the radioactivity of uranium, but to exist in minerals in only one part in three millions compared with uranium. These three elements are now known to form part of a series of sixteen that by disintegration are being slowly transformed to lead.

[*Lafayette*

The late Mme. Curie

Recognition of the importance of Mme. Curie's work was paid by the Royal Society, which in 1903 awarded her, jointly with her husband, the Davy Medal. In the following year the Curies were associated with Becquerel in the receipt of a Nobel Prize, and she was appointed to a special chair in the Sorbonne in 1906 and later became first director of the Pierre Curie Institute for investigations into radioactivity, which post she held at the time of her death. Other distinctions conferred upon her included the Nobel Prize for Chemistry in 1911 and the Albert Medal of the Royal Society of Arts.

Dr. W. M. Stine.—The death occurred last week in New York at the age of seventy of Mr. Wilbur Morris Stine, Sc.D., Ph.D., well known for his study of X-rays. From 1886 to 1899 he was Professor of Physics at Ohio University, and during the next five years was director of electrical engineering at the Armour Institute of Technology. From 1898 to 1909 he was Williamson Professor of Engineering at Swarthmore, and since the latter date had devoted himself to authorship. He began the study of X-rays in 1891, and announced in 1896 the discovery of the source of the Röntgen rays, and a year later suggested the remedial use of X-rays, especially as a treatment for cancer.

Mrs. Margaret Smeaton Munro, widow of Mr. John M. M. Munro, F.R.S.E., M.I.E.E., and mother of Mr. Donald Smeaton Munro, M.I.E.E., died in Edinburgh on July 7th in her eightieth year.

Wills.—Mr. J. Thompson, senior managing director of Messrs. John Thompson (Wolverhampton), Ltd., left £115,267 (net personalty £113,806).

Mr. L. T. Horne, C.B.E., late assistant secretary of the G.P.O. in charge of telephones, left £6,479 (net personalty £6,351).

Mr. F. Carter, the joint inventor of the Blackstone oil engine, left £21,286 (net personalty £19,139).

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Switchgear Testing Co., Ltd.—Private company. Registered July 2nd. Nominal capital, £30,000 in £1 shares. Objects: To carry on the business of an electrical testing station, in particular to carry out short-circuit and other tests on switchgear, reactances and electrical plant and apparatus of all kinds, &c. The first directors are: W. C. Lusk, 88, Portland Place, W. (director of British Thomson-Houston Co., Ltd.), G. E. Bailey, Oak House, Bankhall Lane, Hale, Ches. (director of Metropolitan-Vickers Electrical Co., Ltd.), H. N. Sporborg, Elmhurst, 42, Hillmorton Road, Rugby (director of British Thomson-Houston Co., Ltd.), and S. Ferguson, Aldersyde, Prestbury Road, Wilmslow, Ches. (director of Ferguson, Pailin, Ltd.). Secretary: R. H. Haviland. Solicitors: T. W. Hall & Sons, Crown House, Aldwych, W.C.2.

Gold Coast & Ashanti Electric Power Development Corporation, Ltd.—Private company. Registered June 30th. Nominal capital, £500 in £1 shares. Objects: To carry on in the Gold Coast Colony and elsewhere in Africa or in any other part of the world the business of electricians, electrical and mechanical engineers, manufacturers, workers, suppliers and generators of and dealers in electricity, motive power and light, &c. The subscribers are: R. W. Forbes, 31/33, Corn Exchange Chambers, E.C.3, merchant, and two others. Registered office is at 72, Victoria Street, S.W.1.

Wolsey Television, Ltd.—Private company. Registered July 4th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical and mechanical appliances, gramophones, musical and scientific instruments, wireless, telephonic and telegraphic apparatus, &c. The first directors are: W. Wolsey, 169, Queen's Road, Finsbury Park, N.4, and G. T. Clack, 30, Terrapin Road, Balham, S.W.12. Registered office: 54, Lamb's Conduit Street, W.C.1.

N.E. Radio Relay Services, Ltd.—Private company. Registered July 4th. Capital, £10,000 in £1 shares. Objects: To carry on the business of distributors and relayers of radio, television and/or other programmes; radio engineers and manufacturers, &c. The permanent directors are: A. Burdon, 1, Salisbury Place, South Shields, and W. C. Hay, 18, Elmsleigh Avenue, Cleadon, nr. Sunderland.

R. Russell (Electrical), Ltd.—Private company. Registered July 4th. Capital, £2,000 in 1,500 6 per cent. cumulative preference shares of £1 and 2,000 ordinary shares of 5s. each. Objects: To acquire the business of electrical engineers and contractors now carried on at 187/9, Upper Richmond Road, Putney, as "R. Russell." The permanent directors are: R. Russell, 4, Brackenview, Mill Hill, Barnes Common, S.W.13, and two others. Registered office: 187/9, Upper Richmond Road, Putney, S.W.15.

J. Westrich, Ltd.—Private company. Registered July 4th. Capital, £100 in £1 shares. Objects: To carry on the business of, dealers in, agents for and manufacturers of wireless, television, electrical, photographic and cinema apparatus and accessories. J. Westrich, 78, Lynton Avenue, N.W.9, is first director. Registered office: 96, Tabernacle Street, E.C.2.

MacGregor & McCallum, Ltd.—Private company. Registered July 5th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in mechanical and electrical appliances for domestic and other purposes, &c. The first directors are: F. J. MacGregor, 41, Cecil Road, North Acton, W.3, and W. C. McCallum, 19, Carson Road, West Dulwich, S.E.21. Registered office: Dominion House, Thames Road, Chiswick, W.4.

Basil Webb, Ltd.—Private company. Registered July 2nd. Capital, £100 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in electrical machinery and components, radio equipment, &c. The first directors are: B. Webb, and Mrs. Marjorie I. Webb, both of Chelmarsh, Broadway West, Walsall. Registered office: Tudor House, Bridge Street, Walsall.

Rexvia Radio, Ltd.—Private company. Registered July 6th. Capital, £500 in £1 shares. Objects: To acquire the assets, contracts, goodwill and business of Richard E. Lancaster-Johnson, trading as "Kingsway Radio," of Southampton, and to carry on the business of wholesale and retail electrical, radio and television dealers, &c. The first directors are: F. G. L. Joslen, 66, Chessil Avenue, Bitterne, Southampton; and R. E. Lancaster-Johnson, 7, Grosvenor Mansions, Polygon, Southampton. Secretary: F. G. L. Joslen. Registered office: 50, Commercial Road, Southampton.

Master Radio & Electrical Co., Ltd.—Private company. Registered July 7th. Capital, £500 in £1 shares. Objects: To acquire the business of radio manufacturers now carried on by Leslie F. Lambert and Anne Kearney at 102/105, Shoe Lane, E.C.4, as "The Master Radio Co." The permanent directors are: L. F. Lambert, "Cambrai," 163, Gunnersbury Lane, Acton, W.3; and two others. Registered office: 102/105, Shoe Lane, E.C.4.

Returns of Electrical Companies

Cliffdown Electrical Appliances, Ltd.—Particulars filed of £3,000 debentures, authorised May 11th, 1934, charged on the company's property and assets, present and future, including uncalled capital, the amount of the present issue being £300.

Alton Battery Co., Ltd.—Satisfaction in full on May 25th, 1934, of mortgage dated January 12th, 1922, and registered same date. (According to the register of mortgages, the mortgage registered January 12th, 1922, originally secured £4,750, and all other moneys due to bank.)

Altrincham Electric Supply, Ltd.—Satisfaction in full on June 21st, 1934, of debenture dated November 14th, 1924, and registered December 4th, 1924, securing £80,000.

E. Jeffery, Ltd.—H. V. Went, 26, Charing Cross Road, W.C.2, ceased to act as receiver and manager on June 27th, 1934.

Shrosbery Bakewell & Co., Ltd. (in liquidation).—D. R. Evans, 29-30, King Street, Cheapside, E.C.2, ceased to act as receiver and/or manager on June 26th, 1934.

Simpsons Electricals, Ltd.—A. Hastings, 32, Kenver Avenue, N.12, ceased to act as receiver and manager on June 27th, 1934.

Amesbury Electric Light & General Supply Co., Ltd.—Capital, £3,000 in £1 shares. Return dated April 12th, 1934. All shares taken up. £3,000 paid. Mortgages and charges, nil.

Dynamic Electrical Co., Ltd.—Capital, £100,000 in 1s. shares. Return dated May 9th, 1934. 1,500,000 shares taken up. £75,000 paid. Mortgages and charges, nil.

Craig (Radio), Ltd.—Capital, £200 in £1 shares. Return dated January 11th (filed April 13th), 1934. 200 shares taken up. £200 paid. Mortgages and charges, nil.

Electra, Ltd.—Issue on June 27th, 1934, of £200 debentures, part of a series already registered.

Forest City Electric Co., Ltd.—Capital, £5,000 in £1 shares. Return dated February 17th, 1934. All shares taken up. £2,210 paid, £2,790 considered as paid. Mortgages and charges nil.

Impex Electrical, Ltd.—Capital, £14,000 in £1 shares. Return dated March 2nd, 1934. All shares taken up. £14,000 paid. Mortgages and charges nil.

Folkestone Radio Relays, Ltd.—Particulars filed on June 27th, of £700 debentures authorised March 26th, 1934, charged on the company's undertaking and property, including uncalled capital (but excluding freehold premises in Invicta Road, Folkestone), the whole amount being now issued.

Berry & Wilson, Ltd.—C. E. Claridge, 53, Well Street, Bradford, ceased to act as receiver and/or manager on June 16th, 1934.

A. E. Naylor, Ltd.—W. Hand, 12, Cherry Street, Birmingham, was appointed receiver and manager on June 27th, 1934, under powers contained in instrument dated February 22nd, 1933.

Singapore Traction Co., Ltd.—Capital, £400,000 in 200,000 preference and 199,999 ordinary shares and 1 "reversionary" share of £1. Return dated February 28th, 1934. 200,000 preference and 165,208 ordinary shares and one reversionary share taken up. £7 paid. £365,202 considered as paid. Mortgages and charges, £118,440.

Hall Telephone Accessories (1928), Ltd.—Capital, £250,000 in 10s. shares. Return dated March 5th, 1934. 403,200 shares taken up. £82,188 10s. paid on 164,377 shares. £119,411 10s. considered as paid on 238,823 shares. Mortgages and charges, nil.

Metallic Seamless Tube Co., Ltd.—Capital, £65,333 6s. 8d. in 20,000 preference shares of 13s. 4d. and 260,000 ordinary shares of 4s. each. Return dated February 23rd, 1934. 15,245 preference and 260,000 ordinary shares taken up. £36,163 6s. 8d. paid on 15,245 preference and 130,000 ordinary shares. £26,000 considered as paid on 130,000 ordinary shares. Mortgages and charges, nil.

Pan-Electric, Ltd.—Capital, £200 in £1 shares. Return dated March 8th, 1934. All shares taken up. £196 paid. £4 considered as paid. Mortgages and charges, nil.

Kadette, Ltd.—R. M. Peat, 11, Ironmonger Lane, E.C., ceased to act as receiver and/or manager on June 28th, 1934.

Pollson, Ltd.—Debenture dated June 27th, 1934, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Jasper Gibson, White Gables, Abbots Langley, Herts.

Instanta Electric Signal Clocks, Ltd.—The nominal capital has been increased by the addition of £900 in £1 ordinary shares beyond £100.

Harry Astbury, Ltd.—Capital, £1,000 in £1 shares. Return dated March 29th, 1934. 366 shares taken up. £366 paid. Mortgages and charges, nil.

City Notes

Greenwood & Batley, Ltd.—Presiding at the annual meeting held on July 7th, Col. H. A. Micklem (chairman) said that they were making steady progress and the result of the past year's working was the best obtained in the last four years. An appreciable amount of experimental work had been undertaken in the course of the year. This applied particularly to the oil mill, turbine, tool and textile departments. Several machines specially designed for use with high-speed cutting tools had been added to their plant in the course of the year, some of which were of their own manufacture. Regarding the current year, up to date the combined sales and orders on hand were appreciably larger than on the corresponding date last year. Against this a reduction of the income from investments, &c., must be anticipated owing to the low rates prevailing. He was hopeful, however, that they would be able to maintain their position.

Petters, Ltd., report a loss for the year ended March 31st last of £25,794. A balance of £19,948 is brought in, £25,000 is transferred from reserve, and, after payment of the interest on the funding certificates, a balance of £17,860 is carried forward. The report states that heavy losses on foreign exchange, foreign bad debts, and consignment accounts arising out of the world situation during the past three years have had to be provided for out of the current accounts for the years concerned. It is hoped that these losses have now come to an end. In the Engine Department sales have been maintained. The volume of business has been steadily increasing during the current year and the outlook at present is more favourable than has been the case for a considerable time.

The Victoria Falls & Transvaal Power Co., Ltd., reports a gross revenue for 1933, including interest, &c., of £1,269,905, as compared with £1,393,240 in the preceding year, and a net profit of £360,959 (against £400,210), to which is added £276,764 brought in, making £637,723. Reserve receives £50,000 and the final ordinary dividend is 12 per cent., making 15 per cent. for the year, leaving £285,438. In addition, a bonus of 5 per cent. is paid out of the balance of exchange appearing to the credit of reserve fund No. 2. Similar payments were made for 1932. The report states that the sales during 1933 showed a satisfactory increase over those of the previous year and the sales for the first six months of the current year show a still further advance. The growth of the output having substantially increased since the present prices were negotiated with consumers in 1924, and the increased sterling price of gold having shown that requirements for power would still further increase, the company entered into negotiation with its principal consumers and settled terms for extending the existing contracts from 1942, as at present, to 1950, at reduced prices with effect from January 1st, 1933. The reduction of price, while affecting the result for the year, has materially enhanced the stability of the business for the future. The amended terms are calculated to permit the company to continue the dividends hitherto paid and to make the same contributions to reserve fund and provide adequately for depreciation. The amended terms also provide for the company receiving a reasonable share of the results from future increases of business and adjusting prices if business falls below the level of that transacted in the year 1933. In order to meet the growth of load which is now taking place, it has become necessary to erect another generating station, and arrangements have been completed with the Electricity Supply Commission for this to be erected a few miles distant from the present Vereeniging station. This will be known as the Klip generating station, and will have an initial capacity of about 100,000 kW. It will be erected and operated by the company, which will take the entire output at cost, but the station will be owned by the Commission. In order to meet a demand for power which may arise outside the company's present area of supply, an arrangement has been come to with the Commission whereby the latter has obtained a licence to supply a large area surrounding the company's present area and has ceded the licence to the company, which, except in abnormal cases, will supply consumers in the extended area on the basis of its ordinary tariffs and will furnish the supply required from the system as a whole. It is a part of the arrangement with the Commission that, generally speaking, the transmission system within the extended area will be owned by the Commission but will be erected and operated by the company. As a further part of the general arrangement it has been agreed with the Commission that the company will operate the new Klip generating station, the transmission system in the new area and also the present Witbank generating station, which is the property of the Commission, during such time as the company is carrying on the business of an authorised undertaker.

E. K. Cole, Ltd., report a trading profit for the year ended May 31st last of £166,618, as against £36,519 for the preceding accounting period of sixteen months; to this is added £17,250 received in respect of insurance claim for loss of profits arising out of the fire at the works in February, 1932. After providing for depreciation, income tax reserve, &c., and placing £50,000 to general reserve, it is proposed to pay a final ordinary dividend of 10 per cent., making 20 per cent. for the year and to carry forward £22,970, against £5,028 brought in.

W. & T. Avery, Ltd., report a net profit for the year ended March 31st last of £102,925, as compared with £95,512 for 1932-33, which with £59,124 brought in makes £162,049. The final ordinary dividend is 10 per cent., maintaining the distribution for the year at 15 per cent., and £59,590 is carried forward.

The Southern Areas Electric Corporation is holding a meeting on Monday next at which a proposal will be submitted for increasing the capital to £350,000 by the creation of 100,000 ordinary shares of £1 each.

The Hydro-Electric Securities Corporation has declared the usual half-yearly dividend on the 5 per cent. "B" cumulative participating preferred shares.

The Notting Hill Electric Lighting Co., Ltd., has declared an interim ordinary dividend of 4 per cent. (same).

The Yorkshire Electric Power Co. is again paying an interim ordinary dividend of 3 per cent.

The Electrical Distribution of Yorkshire, Ltd., is maintaining the interim dividend on the ordinary shares at 4½ per cent.

The United Dominions Trust (Electric), Ltd., according to the report of its parent company, the United Dominions Trust, Ltd., has paid to the latter a dividend at the rate of 10 per cent., less tax. The deferred income account at £3,799 is increased, as also is rebate of interest account at £17,597. The carry-forward is £3,593.

The Kalgoorlie Electric Power & Lighting Corporation, Ltd.—At an extraordinary meeting held on July 10th a resolution was approved to increase the capital to £125,000.

The Anglo-American Telegraph Co. has announced an interim dividend for the quarter ended June 30th of ¾ per cent. (same) on the ordinary stock.

The Great Northern Telegraph Co.'s Holding Co., Ltd., proposes to distribute for the sixth financial year ended June 30th last a total dividend of 23½ per cent. or Danish kr. 12.69 per share of kr. 54, to set aside kr. 400,000 for taxes, and to carry forward kr. 16,329.01. The dividend will be payable in London at the rate of exchange ruling on the day of payment.

Stocks and Shares

TUESDAY EVENING.

THE Stock Exchange markets are feeling the heat in a manner which the quietude of prices amply demonstrates. It is a common experience every year that hot weather, even more than holiday time—the two often coincide at this time of the year—saps the enterprise which, in more normal conditions of the atmosphere, people exhibit in connection with Stock Exchange operations. At the present time prices are firm without there being any especially outstanding feature. Hints are beginning to make themselves heard of a possibility of money tightness. Some of the pessimists prate of a 3 per cent. Bank Rate as against the 2 per cent. that has ruled since June 30th, 1932. The opinion is held more generally, however, that the period of cheap money will continue for at least another six months, though in any matters relating to money it is always dangerous to prophesy. That no particular fear is felt in regard to the likelihood of an early rise in Bank Rate, the strength of the prices of gilt-edged securities abundantly shows. Central Electricity 3½ per cent. stock has risen to 100. The Board's 4½ per cent. 1951-73 stock is quoted ex dividend at 108. London Passenger Transport "A" and "B" stocks are a little easier, apparently on sales made in order to exchange into the Board's "C" stock. The latter has risen 4 points to 81½, the demand being stimulated by talk of what dividend the stock is likely to receive. The announcement is due to be made during the present month and the uncertainty attaching to what will be paid is the reason, of

course, for fluctuations which, in their abruptness, seem more appropriate to mining shares than to a staid stock attached to the London Passenger Transport Board.

Home Electricity Supply Shares

Nearly all the ordinary shares in the list of Home electricity supply companies are now quoted ex dividend. It becomes, therefore, of particular interest to observe the yields that the group affords. Yorkshire Electric Power ordinary at the present price pay £3 8s. per cent. on the money, North Eastern ordinary £3 12s. 6d. per cent., Northampton ordinary £3 14s. 4d. per cent. There is still a marked scarcity of supply and, in the circumstances, it may be of service to mention cases in which small blocks of shares, from 500 to 2,000, are available. These include the ordinary shares of Bournemouth & Poole, Electrical Distribution of Yorkshire, Hendon (at 55s.), Lancashire, Metropolitan, Midland Counties, Midland Electric Corporation, and Scottish Power. These give an idea of the amounts of shares that can be bought in the open market, at prices approximately the same as those quoted, officially, and repeated in our lists. Lines of 1,000 to 2,500 ordinary shares are available in the cases of several London companies, *e.g.*—Brompton and Kensington, Charing Cross, Chelsea, South London and Westminster. From these an average return of a little over 4 per cent. on the money can be obtained, assuming payment of the standard rate of dividend at 7 per cent., a rate which it is hoped by some of the optimists will be improved upon in respect of the present twelve months.

The increase of electricity generated by authorised undertakings in Great Britain during June is very substantial. The additional electricity used in the past six months, as compared with the corresponding period of a year ago, represents rather over 17 per cent.

Manufacturing and Equipment Shares

Aron Electricity Meter has published very good figures for 1933-4, and the ordinary shares are now quoted at 52s. 6d., ex the dividend of 6 per cent. that made 10 per cent. for the year. The chief feature in the manufacturing section is a rise of 3s., to 45s., in General Electric ordinary shares. Substantial buying is said to have been encouraged by knowledge of the progress the company is making. The 6½ per cent. preference hardened to 32s. 6d. British Insulated have gone back to 70s.

Cables and Wireless

The market in Cables and Wireless stocks has been quiet during the past few days, suffering in common with most other parts of the Stock Exchange from the lack of energy and enterprise for which the heat is generally blamed. The favourable effect produced by the publication of last month's traffics remains to some extent. The stocks are, however, attracting comparatively little attention and the principal movement in the group is a rise of 10s. in Globe Telegraph and Trust ordinary shares, taking the price to £9.

Of the American issues, American Telephone & Telegraph stock is virtually unchanged at 114½. International Telephones remain at 12¼. Marconi Marines eased off to 29s. 6d., despite a statement to the effect that before long there is to be an extension of the company's instruments to many more ships than are obliged at present to carry them.

Telephone Manufacturing are steady at 3s. 6d. and Telephone Rentals at 8s. Something of a feature during the past few days has been an improvement in International Automatic Telephone ordinary which touched 37s. 9d. before reacting to 37s. The company's "B" preferred shares have been moving in correspondence and are now 36s. Hall Telephone Accessories are marked ex dividend, at 18s. 3d. Telephone & General Trust ordinary hold their previous price of 29s. 6d.

New Telephone Charges

The Post Office has issued its reduced telephone rates and revised conditions, particulars of which were advertised in the daily Press a month or two ago. Users of the telephone will observe with interest the saving which private people will enjoy, and which ought to give an impetus to the use of telephones throughout the country. In the radio world, the E. K. Cole Company has announced a final dividend of 10 per cent., making 20 per cent. for the year. The accounts show a remarkable improvement over those of a year ago.

Iron and steel shares are quietly steady, and rubber shares show a healthy disposition, with a good many rises since this time last week.

Safety First!

It may be thought that to raise a warning against the wiles of bucket-shops is to travel outside the province of a weekly article like this. Justification may be pleaded, however, on account of the energy and activity being exhibited by the type of dealer in stocks and shares whose blandishments should be ignored by anyone having a regard for his own money. The telephone, the telegraph and the postal service are being employed in the service of people whose plausibility is as engaging as their methods are shady. Innocent investors, men and women, too, are fleeced every day by financial "gangsters" whom neither the Public Prosecutor nor the police have the courage to tackle. In such circumstances, then, this effort to put readers on their guard may perhaps be pardoned.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1932.	Dividend. 1933.	Price. July 10.	Rise or Fall.	Yield. p.c. £ s. d.
Bournemouth and Poole	1	15	15	75/9	—	3 19 2
Brompton Ordinary	1	7	7	34/–	—	4 2 4
Charing Cross Ordinary	1	7	7	34/–	—	4 2 4
Chelsea	1	7	7	34/–	—	4 2 4
City of London	1	7½	7½	35/–	—	4 5 9
Clyde Valley	1	7	7	40/–	—	3 10 0
County of London	1	10½	10½	57/6	—	3 13 1
Edmundson's 7% Pref.	1	7	7	34/–	—	4 2 4
Elec. Dis. Yorkshire	1	9	9	47/–xd	+9d.	3 16 6
Elec. Supply Corporation ...	1	11	11	58/3	+9d.	3 15 10
Kensington Ordinary	1	7	7	34/–xd	—	4 2 4
Lancs Light and Power	1	7	7½	37/6	—	4 0 0
London Electric	1	7	7	34/6	—	4 1 2
Metropolitan	1	10	10	52/6	–	3 16 2
Midland Counties	1	7	7	37/6	—	3 14 8
Mid. Elec. Power	1	8	8	42/–	—	3 16 2
North Eastern Electric Ordinary	1	6	6	33/–	—	3 12 10
Do. 7% Pref.	1	7	7	35/–	—	4 0 0
Northampton	1	10	10	53/9	–¼	3 14 4
Notting Hill 6% Pref.	10	6	6	14½xd	+5/–	4 2 9
North Met. Elec. Ordinary ...	1	10	10	62/6	—	3 4 0
Do. do. 6% Pref. ...	1	6	6	31/–	—	3 17 5
St. James' and Pall Mall ...	1	7	7½	35/–xd	—	4 5 9
Scottish Power	1	8	8	40/–	—	4 0 0
South London	1	7	7	38/–	—	3 17 9
Westminster Ordinary	1	7	7	34/–	—	4 2 4
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	21/–	—	7 2 10
Yorkshire Elec.	1	8	8	47/–xd	—	3 8 1

PUBLIC BOARDS.

Central Electricity, 1950–70 ...	Stock	5	5	116	—	4 6 2
Do. 1955–75 ...	,,	5	5	117	—	4 5 6
Do. 1951–73 ...	,,	4½	4½	109	—	4 2 7
Do. 1963–93 ...	,,	—	3½	100	+1	3 10 0
London & Home Counties, 1955–75	,,	4½	4½	108xd	—	4 3 4
London Passenger Transport, A...	,,	—	4½	117	–1	3 17 0
Do. do. B...	,,	—	5	121	–1	4 2 8
Do. do. C...	,,	—	—	81½	+4	—
West Midlands Joint Elec. 1948–68	,,	—	5	114	—	4 7 9

TELEGRAPH AND TELEPHONES.

American Tel. & Tel.	$100	9	9	114½	—	7 17 3
Anglo-Am. Tel. Pref.	Stock	6	6	113½	—	5 5 9
Do. Def.	,,	1½	1½	27½	—	5 9 1
Cables & Wireless 5½% Pref. ...	,,	2¾	2¾	69½	+1	3 19 2
Do. A. 7½% Ord.	,,	Nil	Nil	14½	–¼	—
Do. B. Ord.	,,	Nil	Nil	7¾	—	—
Globe Tel. and T. Ord.	10	Nil	2½	9	+½	2 15 6
Do. do. Pref.	10	6	6	12¾	—	4 15 1
Great Northern Tel.	10	20	20	36	–½	5 9 7
Marconi-Marine	1	10	7½	29/6	–6d.	5 1 8
Oriental Telephone Ord.	1	12	12	3½	—	*3 16 10

HOME AND FOREIGN TRAMS, ETC.

Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	1/6	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	4½	—	—
British Electric Traction Df. Ord.	,,	5	5	595	—	—
Do. do. Pref. Ord.	,,	8	8	157½	—	5 1 7
Brazil Traction	100	—	—	8¾	+¼	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	106	+1	4 14 3
Mexico Trams, 5% Bonds ...	—	5	5	24½	—	20 8 0
Mexican Light Common	100	Nil	Nil	3½	—	—
Do. 7% Pref.	100	7	7	7½	—	—
Do. 1st Bonds...	—	5	5	49½	—	10 10 6
Victoria Falls Ord.	1	15	20	6½	–¾	3 5 4
Yorkshire (West Riding) ...	1	2½	5	25/9	—	3 17 8

MANUFACTURING COMPANIES

Assoc. Elec. Ord.	1	4	3	18/6	—	3 4 10
Do. Pref.	1	8	8	32/–	—	5 0 0
Babcock & Wilcox	1	9	6	39/6	—	3 0 9
British Aluminium Ord.	1	5	5	28/3	—	3 11 0
British Insulated Ord.	1	15	15	70/–	–¼	4 5 9
Brush Ord.	Stock	Nil	Nil	33	—	—
Callender's	1	15	15	3½	—	4 16 1
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord. ...	5/–	22½	12½	25/6	—	4 18 4
Do. 8% Pref.	1	8	8	32/6	—	4 18 6
Edison-Swan 1st Pref.	1	7½	7½	22/6xd	+6d.	6 13 4
Do. 5% Deb.	Stock	5	5	107½	—	4 13 0
Electric Construction	1	Nil	Nil	11/3	—	—
Enfield Cable Ord.	1	25	20	86/3	—	4 13 0
English Electric	1	Nil	Nil	5/9	—	—
Do. do. Pref.	1	Nil	Nil	9/6	—	—
Ever Ready	5/–	35	35	28/6	—	6 2 8
Ferranti Pref.	1	7	7	27/–	—	5 3 3
G.E.C. Pref.	1	6½	6½	32/6	+6d.	4 0 0
Do. Ord.	1	8	8	45/–	+3/–	3 11 2
Henley's	1	30	30	6½	—	4 17 8
Do. 4½% Pref.	5	4½	4½	5½	—	4 1 9
India-Rubber Preferred	1	—	—	18/9	—	—
Johnson & Phillips	1	5	5	22/6	—	4 9 0
Siemens Ord.	1	6½	4	17/6	—	4 11 6
Telegraph Construction	£1	Nil	Nil	1	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parenthesis are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken

1932

28519. "Electric fuses." V. Hope. October 13th, 1932. (411861.)

29134. "Cathode-ray tubes." International General Electric Co., Inc. October 19th, 1931. (411883.)

31679. "Electric phase-difference responsive devices." British Thomson-Houston Co., Ltd. November 9th, 1931. (411836.)

32873. "Gaseous electric discharge devices and methods of making the same." British Thomson-Houston Co., Ltd. November 21st, 1931. (411931.)

32914. "Sealing of electrical conductors into gasfilled quartz containers." British Hanovia Quartz Lamp Co., Ltd. March 8th, 1932. (411933.)

43208. "Electric control systems." A. S. Fitzgerald. December 2nd, 1932. (Cognate application 14683-33.) (411831.)

34209. "Electric regulating and control systems." A. S. Fitzgerald. December 2nd, 1932. (411832.)

34663. "Protection of electric accumulators against self-discharge and corrosion of the terminals." W. Kuhn, R. Block, E. Demme and H. L. Lehmann. December 7th, 1932. (411833.)

34748. "Apparatus for reproducing on an incandescent lamp screen pictures derived from kinema films." H. Rosenberg. December 8th, 1931. (411819.)

34829. "Holders for electric incandescent lamps." E. R. Grote. December 8th, 1932. (411849.)

35320. "Vibrators including electric motors, suitable for vibrating the hand of a massagist." C. Cahier. December 13th, 1932. (411865.)

35450. "Centrifugal devices for example electric switches." Hobart Manufacturing Co. December 31st, 1931. (411898.)

35459. "Control of colour-lighting apparatus." Holophane, Ltd., and R. G. Williams. December 14th, 1932. (Cognate application 35460/32.) (411868.)

35484. "Electrical condensers." W. J. Tennant (Solar Manufacturing Corporation). December 14th, 1932. (411858.)

35490. "Long-distance telephone cable, and more particularly long-distance telephone ocean cable." Siemens and Halske Akt-Ges. December 14th, 1931. (411901.)

35502. "A.C. electricity meters." Ferranti, Ltd., and E. Chesworth. December 14th, 1932. (411872.)

35619/20. "Pressure wave-transmitters and receivers incorporating magneto-strictive devices." Marconi International Marine Communication Co., Ltd., and N. P. Hinton. December 15th, 1932. (411879 and 411903.)

35696. "Evacuating arrangements for evacuating apparatus for example mercury-arc rectifiers." General Electric Co., Ltd., and E. Gallizia. December 16th, 1932. (411911.)

36242. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and L. Griffiths. December 21st, 1932. (411936.)

36527. "Electric cut-out or protective systems with automatic circuit-breakers." A. M. Haslev. December 23rd, 1932. (411942.)

1933

1367. "Braun tube." Dr. K. Schlesinger. January 16th, 1932. (411955.)

1547. "Holders for electric incandescent lamps." E. R. Grote. January 17th, 1933. (411957.)

2357. "Electric signalling or indicating means." H. T. Ringrose. January 25th, 1933. (411959.)

4968. "Electricity meters." British Sangamo Co., Ltd., and F. R. Butherus. February 17th, 1933. (411978.)

6799. "Apparatus for testing electric signals." General Electric Co., Ltd., and D. C. Espley. March 6th, 1933. (Cognate application 6922/33.) (411990.)

8624. "Electric fires." Ferranti, Ltd., and W. V. Butterfield. March 22nd, 1933. (412001.)

11381. "Electric cables." H. Milliken and British Insulated Cables, Ltd. April 18, 1933. (412017.)

13002. "Electric discharge tubes chiefly for television and luminescent relays." Soc. des Lampes Fotos. May 4th, 1932. (412024.)

13350. "Apparatus for the decomposition and composition of pictures particularly in television." I.M.K. Syndicate, Ltd. May 21st, 1932. (Cognate application 13351/33.) (Addition to 394446.) (412026.)

14301. "Electric mixing-machines." British Thomson-Houston Co., Ltd., and A. T. Stretton. May 17th, 1933. (412030.)

14760. "Luminous electric discharge tubes." General Electric Co., Ltd., and J. W. Ryde. May 22nd, 1933. (412031.)

21173. "Measurement of lightning discharges." British Thomson-Houston Co., Ltd. July 27th, 1932. (412051.)

21487. "Suspended lamps for shop lighting and like purposes." Holophane, Ltd. February 9th, 1933. (412053.)

21787. "Wireless receivers." Radioakt-Ges D. S. Loewe and Dr. P. Kapteyn. August 4th, 1932. (412054.)

26993. "Brackets and holders for electric lamps." Moulded Products, Ltd., and E. A. Sanders. October 2nd, 1933. (412077.)

30081. "Television apparatus." Marconi's Wireless Telegraph Co., Ltd. October 29th, 1932. (412092.)

30453. "Cooling means for mercury-vapour rectifiers and other electric discharge apparatus." English Electric Co., Ltd. November 2nd, 1932. (412095.)

32480. "Arrangement for the electric cutting of metals." Elin Akt-Ges. für elektrische Industrie. November 21st, 1932. (412111.)

34173. "Separable electrical contact devices." Cinch Manufacturing Corporation. December 13th, 1932. (411826.)

36044. "Television and like apparatus." Fernseh Akt-Ges. December 23rd, 1932. (412126.)

1934

2925. "Method of and apparatus for electric welding." Pressed Steel Co. of Great Britain, Ltd., and W. S. Simmie. November 1st, 1933. (Divided application on 27168/32.) (412140.)

3291. "Ignition electrodes for glass-bulb type mercury-vapour rectifiers." English Electric Co., Ltd. January 31st, 1933. (412144.)

5505. "Metal-vapour rectifiers." English Electric Co., Ltd. February 20th, 1933. (412148.)

5506. "Metal-vapour rectifiers." English Electric Co., Ltd. February 24th, 1933. (412149.)

6199. "Tuning arrangements for high-frequency circuits." British Thomson-Houston Co., Ltd. March 1st, 1933. (412152.)

6639. "Electron-discharge device oscillation generators." Marconi's Wireless Telegraph Co., Ltd. March 1st, 1933. (412154.)

12060. "Gasfilled electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 24th, 1933. (412158.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from July 4th :—

Newlex. No. 550790. Class 6. Electric vacuum cleaning machines.—Ilford Electrical Co., Ltd., 4, High Road, Ilford.

Signaphon. No. 547225. Class 8. Automatic signalling apparatus for operating telephone systems in an emergency.—D. A. Craig, trading as the British Signaphone Co., Grand Buildings, Trafalgar Square, W.C.2.

Halcyon (lettering and design). No. 545530. Class 8. Radio and television receiving and transmitting apparatus and parts thereof.—Halcyon Radio, Ltd., 155, Norfolk Street, Sheffield.

Glixor. No. 550824. Class 8. Wireless telephonic, telegraphic, and television apparatus and parts thereof.—Glick's Radio, Ltd., 14, Tudor Street, Cardiff.

Synchromatic. No. 550923, and Synchrophonic. No. 551084. Class 8. Radio receiving sets.—Radio Instruments, Ltd., Purley Way, Croydon.

Magrola. No. 551609. Class 11. Electrical massage apparatus.—A. E. Chapman, 125, Stanley Park Road, Carshalton, Surrey.

Stersalite. No. 549122. Class 13. Electric lamps (ordinary).—Albion Electric Lamp Works (1934), Ltd., 2, Bay K, Buckingham Avenue, Trading Estate, Slough, Bucks.

South African Electrical Imports

BELOW are given the values of electrical goods imported into South Africa last year, with a note of the principal suppliers and the increase or decrease compared with 1932. Great Britain is still the chief supplier, the only noteworthy competition being that of the United States in radio material and of Canada in heating and cooking apparatus.

	1933. £(000).	Inc. or dec. £(000).
Cable and wire—		
Total	455	+ 233
From United Kingdom ...	408	+ 210
„ Germany	16	—
„ Sweden	13	+ 13
Heating and cooking apparatus—		
Total	195	+ 53
From United Kingdom ...	73	+ 29
„ Canada	82	+ 23
„ Germany	12	+ 2
„ United States	26	—
Meters—		
Total	23	— 11
From United Kingdom ...	22	— 9
Insulators (porcelain)—		
Total	9	— 1
From United Kingdom ...	4	— 3
Other electrical material and fittings—		
Total	460	+ 415
From United Kingdom ...	306	+ 296
„ Germany	49	+ 42
„ Denmark	9	+ 3
„ Sweden	27	+ 14
„ United States	55	+ 48
Electric hand lamps—		
Total...	14	+ 6
From United Kingdom ...	3	+ 2
„ United States	4	— 1
„ Japan	3	+ 3
Other electric lamps—		
Total	127	+ 9
From United Kingdom ...	64	+ 11
„ Austria	10	+ 1
„ Germany	6	— 1
„ Holland	24	— 3
„ Japan	7	+ 4
„ United States	5	— 2
Self-contained electric lighting outfits—		
Total	4	+ 2
From United Kingdom ...	2	+ 1
„ United States	2	+ 1
Radio material—		
Total	220	+ 106
From United Kingdom ...	58	+ 43
„ Holland	11	— 2
„ United States	147	+ 63
Batteries, primary—		
Total	92	+ 27
From United Kingdom ...	42	+ 15
„ Germany	5	+ 2
„ United States	42	+ 10
Batteries, secondary—		
Total	81	+ 41
From United Kingdom ...	43	+ 22
„ Germany	5	+ 4
„ United States	30	+ 13
Dynamos and generators—		
Total	16	+ 6
From United Kingdom ...	13	+ 6
Motors—		
Total	169	+ 82
From United Kingdom ...	120	+ 64
„ Germany	21	+ 13
„ United States	14	—
Transformers—		
Total	95	+ 8
From United Kingdom ...	66	—
„ Germany	12	+ 4
„ United States	9	+ 3
Other electrical machinery and parts—		
Total	306	— 303
From United Kingdom ...	254	— 216
„ Germany	7	— 41
„ Sweden	36	+ 16
„ United States	8	— 54
Telephone and telegraph material—		
Total	33	+ 16
From United Kingdom ...	24	+ 11

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—School and extensions to existing schools (£184,250); city architect.

Airdrie.—Public swimming baths (£12,000); burgh surveyor.

Aldershot.—Houses (48); borough surveyor.

Anglesey.—Houses (100) and bungalows, Bay View Estate, Benllech Bay; Sargent & Annable, builders, 66, Mosley Street, Manchester.

Atherton.—Houses (82), Hag Fold Estate (£23,020); G. J. Seddon, Ltd., builders, 5, Manchester Road, Little Hulton, near Bolton.

Aylesbury.—Extensions, Royal Bucks Hospital (£25,000), for the governors; secretary.

Barking.—Houses, Movers Lane Estate (£48,490), and a new Town Hall; borough engineer.

Barnsley.—School extensions (£22,650), for Borough E.C.; director of education Medical services clinic (£12,800); P. P. Taylor (Doncaster), Ltd., builders.

Bilston.—Houses (108), Bradley Lodge site; W. G. Lofthouse, architect. Library, museum and art gallery (£13,400); borough surveyor.

Birstall.—Houses (76), Muffitt Lane; U.D.C. surveyor.

Bootle.—Houses (108), Caddicks Estate (£33,480); Leyland Construction Co., Ltd.

Bridlington.—Bus station for the East Yorkshire Motor Services, Ltd. (£10,000); R. T. Tarran, Ltd., builders, Ryde Avenue. Hull.

Bristol.—Houses (300), Southmead Estate; First National Housing Trust, Ltd. Tenements, &c., Great Ann Street area (£113,375); city engineer.

Bromley (KENT).—Houses (100), Wellington Park Estate; New Ideal Homesteads, Ltd.

Burton-on-Trent.—School (560 places), Clarence Street, for Borough E.C.; director of education.

Canterbury.—Houses (162), Thanington; borough surveyor.

Cheadle and Gatley.—Houses (1,200), Adswood Hall Estate. for Adswood Estates, Ltd.

Cheshunt.—Houses (65), Blindman's Lane, for Hannaford & Sons. Houses (109) and shops, High Street, Waltham Cross,, for H. French.

Chester-le-Street.—Houses (70), Pelton Fell; U.D.C. surveyor.

Connah's Quay.—Houses (20); H. Price, builder, Ewloe.

Coventry.—Houses (93), Holbrooke Lane; Whitmore Park Estate Co., Ltd. School, Coundon, for City E.C.; director of education.

Darlington.—Senior schools, Hundens, for Borough E.C.; E. Minors, borough surveyor.

Dewsbury.—Extensions, Wheelwright Grammar School (£11,500), for Borough E.C.; director of education.

Dudley.—Houses (220), Wren's Nest Estate; F. H. Gibbons, borough engineer. School, Blowers Green (£11,400); Mark Round & Sons, Ltd., builders.

Dumbartonshire.—School, Clydebank (£65,000), and special school for the western area (£28,000), and additions to Twechar Public School (£9,000); county clerk, Dumbarton.

Durham.—Houses (144); G. M. Pearson, builder.

Eccles.—Houses (30); J. F. Moore, Ltd., builders.

Esher.—Cinema, Portsmouth Road; J. Hill, architect, 34, Gordon Square, London, W.C.

Essex.—Extension to Hospital, Waltham Abbey (£75,000), C.C.; Jno. Stuart, county architect, Chelmsford.

Farnham (SURREY).—Hospital (£12,000); H. Y. Margary, architect.

Felling-on-Tyne.—Houses (53); C. W. Hall, U.D.C. surveyor, Council Offices.

Fifeshire.—Houses (1,602), in five years, for C.C.; G. Sandilands, Education Offices, Kirkcaldy.

Glasgow.—Cinema, Shawlands (£40,000); H. Winocour, proprietor, Calder Picture House, Govanhill.

Gloucester.—Cinema, King's Square, electrical work, for West of England Cinemas, Ltd.

Hailsham.—Houses (100), Ersham Lodge Estate, for K. Dalgleish.

Halifax.—Houses (50), Ovenden Hall Estate; borough engineer.

Harrow.—Houses (30), Harrow Weald; New Ideal Homesteads, Ltd.

Hemel Hempstead.—Houses (50); A. Murray-Smith, borough engineer.

Hertfordshire.—Schools. St. Albans (£86,850), and Abbot's Langley, for County E.C.; director of education, Hertford.

Horsham.—Houses (40); Building & Public Works Construction Co., Ltd., builders, Swindon.

Hull.—Flats (64), Sykes Street (£17,951); F. Bilton. School, Hall Road; city architect.

Ilford.—Houses (47), Longwood Gardens; A. Smith & Sons. Houses (176), Mossford Park Estate; New Ideal Homesteads, Ltd. Block of shops and flats, High Road (£20,000); Granville F. Siegerts, architect, New North Road. School, Fairlop, for E.C.

Irish Free State.—(WATERFORD).—Hospital (£70,000), for County Hospital Committee.

Kingston-on-Thames.—School, Latchmere (£13,100), for E.C.; B. G. E. Harper, secretary.

Lanarkshire.—School, Coatbridge (£31,000), for C.C.; architect, County E.C., Hamilton.

Leicestershire.—Schools, South Wigston and Barwell, for County E.C.

London.—(STEPNEY).—Dwellings, Ellen Street (£25,200); L.C.C. architect. (WANDSWORTH).—Extensions, Technical Institute (£56,280); L.C.C. architect. (WOOLWICH).—Extensions to the Polytechnic (£60,000); Governors and L.C.C.

Luton.—Houses (42), Toddington; H. Fidler & Son, builders.

Manchester.—Houses (153), Seymour Street, Hurford Avenue, &c.; F. W. Woolfenden & Co., builders, Chapman Street, Gorton. Church, Button Lane, Wythenshawe; Methodist trustees. Elementary school, Sharston, for E.C.

Maybole.—Houses (40), War Memorial Park and Allen's Hill (£11,740); J. M. Johnstone, burgh surveyor, Town Hall.

Middlesbrough.—Houses (190), near Stewarts Sports Field, Acklam; N. Thompson, builder, Sunhouse Street, Linthorpe. Houses (240), Whinney Banks, Brambles Farm and Marton Grove estates; S. E. Burgess, borough engineer, Town Hall.

Moffat.—Houses (30), Whin's site; J. Simmons, burgh surveyor, Town House.

Newburn-on-Tyne.—Cinema, dance hall and shops for the Lyric Theatre Co.; Percy L. Browne & Sons, architects, Pearl Buildings, Northumberland Street, Newcastle-on-Tyne.

Newcastle-on-Tyne.—Houses (190), Fergusons Lane Estate; R. G. Roberts, architect, 18, Cloth Market. Rebuilding of factory, Foundry Lane, for Faith, Ltd. (£10,000); J. C. Clarkson, builder, Matilda Street.

Newton Abbot.—Cinema for the Tower Cinema Co.; H. Williams, architect, 2, St. Andrews Place, Cardiff.

North Riding.—School (432 places), Billingham, for County E.C.; director of education, Northallerton.

Oldham.—Houses (180), Carr Lane, Uppermill; J. Hartley, builder, Cobden Street, Chadderton, near Oldham.

Pershore.—Houses (34); R.D.C. surveyor.

Portsmouth.—Handicraft and domestic subjects centre (£11,382), for Borough E.C.; director of education.

Preston.—Dock offices (£21,617); A. Threlfall, builder, Leyland.

Prestwich.—Houses (200), Prestwich Garden Village Est. J. Lane & Sons, Ltd., building contractors, Heys Road.

Rawmarsh.—Houses (42); U.D.C. surveyor.

Reigate.—Houses (100), Redhill; borough surveyor. Extensions, Poor Law institution (£77,970); Higgs & Hill, Ltd.

Rotherham.—Houses (56), Herringthorpe Valley Road (electrical work), for Miss Hellewell. Swimming baths (£34,000); borough engineer.

Sheffield.—Houses (42), Duncan Road; D. Topliss. Houses (40), Hereward Road; Oxspring Bros. Houses (36), Rippon Road; T. V. & W. L. Simpson. Houses (30), St. Lawrence Lane; T. H. Bailey. Houses (38), Tree Root Walk; J. H. S. Randall, Ltd. Shops and houses, Foxwood Estate; Hallewell Estates, Ltd.

Stockport.—Houses (268), Stockport Road, Cheadle Heath (£75,705); Thos. Davies & Son, builders, Turncroft Lane.

Stourbridge.—Houses (94), Wollescote; Housing, Ltd., Blackheath, builders. Houses (46); A. M. Griffiths & Sons, Ltd., builders, Wolverhampton.

Stretford.—Factory extension, Park Road; D. Anderson & Sons, Ltd. Works extensions, Westinghouse Road, for Metropolitan-Vickers Electrical Co., Ltd.

Surrey.—Schools, St. Helier Estate, Cheam Common (£11,570) and Sutton (£11,780), for County E.C.; secretary, Kingston-on-Thames. Extensions, County Hall, Kingston-on-Thames, for C.C.; E. Vincent Harris, architect, 29, St. James's Square, London, S.W.

Sutton Coldfield.—Houses (40), Clarence Gardens; A. Robinson.

Swindon.—Houses (36), Crickdale Road; R. J. Beswick & Son. Houses (57), Croft Road; A. J. Colborne.

Thornton (FIFE).—Houses (60); Wm. Williamson, Royal Bank Chambers, Kirkcaldy.

Tipton.—Houses (666), Tibbington Estate; U.D.C. surveyor.

Tunstall.—Alterations and additions to British Pottery; T. & R. Boote. Alterations to Ritz Cinema, High Street; Ritz Cinema (Tunstall), Ltd.

Twickenham.—Cinema with dance hall and shops, for F. Benton; J. E. Farrell. Houses (232), Whitton Park Estate; R. Lancaster & Sons.

Tynemouth.—Houses (306), Ridges Estate; J. L. Beckett, borough engineer, Howard Street, North Shields.

Wakefield.—Houses (50), Horbury Road; city architect.

Wallasey.—Houses (72), Mersey Street, and 50 houses at Pasture Road Estate; borough engineer.

Warlingham.—Church, Limpsfield Road; Methodist trustees.

Watford.—Branch library, St. Albans Road (£10,000); borough engineer.

West Hartlepool.—Houses (24), Avondale Avenue; J. J. Fox, builder, 26, Wynnstay Gardens.

West Malling (KENT).—Houses (74); R.D.C. surveyor.

West Riding.—School (560 places), Armthorpe, for County E.C.; director of education, Wakefield. Extensions, Grammar School, Mirfield, near Dewsbury; County architect, County Hall, Wakefield.

Wigan.—Cinema (electrical work), for Falcon Pictures, Ltd. (£30,000); Johnson, Son & Lowe, architects.

Wilmslow.—Houses (300), Fulshaw Park Estate, Knutsford Road; Taylor & Whittaker, builders, the Grange, Irlam Road, Flixton.

Wolverhampton.—Houses (52), Nine Elms Lane; F. Walker. Houses (68), Fallings Park, and extensions, Oldfallings Senior schools (£5,127), for E.C.; A. M. Griffiths & Sons, Ltd., builders. School, Elston Hall, for Borough E.C.; director of education.

Worthing.—Houses (75), vicinity of Pevensey Road; A. W. Clements, Ltd. Church, Moreland Avenue; Chichester Diocesan trustees.